The RUBBER AGE

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First Details of Grasselli - National Aniline Suit

HOFFMANN PATENT SUIT CREATES GREAT INTEREST AMONG CHEMISTS

Importance of Grasselli Chemical-National Aniline Litigation on Hoffmann & Gottlob Patent on Accelerators Brings Out Leading Chemists as Witnesses and Spectators

After many postponements the long-awaited litigation to test the validity of the Hoffmann and Gottlobb patent No. 1,149,580, which was granted by the U. S. Patent office on August 10, 1915, and purchased in December, 1918, from the Alien Property Custodian by the Grasselli Chemical Company, came to trial on Wednesday, February 17, in the U. S. District Court, Southern District of N. Y. with Hon. Augustus M. Hand, District Judge, presiding, and came to an end on March 5.

The suit was brought by the Grasselli Chemical Company against the National Aniline & Chemical Co. for alleged infringement of the above patent as shown by the manufacture of diphenylguanidine and triphenylguanidine by the defendant company. That both sides attach much importance to the result of this litigation is shown by the large number of expert witnesses called and by the numerous exhibits of patents, license agreements, correspondence, laboratory records of various rubber companies, technical books and articles from trade papers, etc., which were introduced into the records.

The attorneys for the Grasselli Chemical Co., were Mayer, Warfield & Watson of 247 Park Ave., N. Y. City, represented in court by F. P. Warfield, L. Bristol and C. P. Townsend. Attorney W. T. Cashman of Cleveland and J. S. Wooster of 233 Broadway, N. Y. City were also in attendance. The attorneys for the National Aniline & Chemical Co., were Pennie, Davis, Marvin & Edmonds of 165 Broadway, N. Y. City, represented by D. S. Edmonds, F. E. Barrows and R. F. Adams.

Among the witnesses called by Grasselli were the following: R. B. Armour, A. G. Boker, H. S. Doty, Preston Furman, C. A. Kraus, J. B. Tuttle, Reston Stevenson, Carl Williams and John Young. Among the witnesses for National Aniline were Chas. R. Boggs, M. H. E. Follansbee, David Spence, Everett Morse, R. D. Parsons, R. W. Kent, H. B. Slusser, W. F. Avery, E. R. Wagner, H. N. McCoy and C. Tyler.

As an indication of the mass of exhibits offered by both sides the following will serve to show how completely every phase of the subject was treated. For the plaintiff (Grasselli) the following were recorded: Hoffmann & Gottlob Patent; National Aniline and Grasselli trade paper advertisements; samples of TPG; Dovan license under patent in suit; License agreements between Grasselli and Perth Amboy Chemical Works; Heyden Chemical Co., and Dovan; and agreements between Synthetic Patents Co., and Heyden and between Dovan and Perth Amboy; various letters from rubber companies to Heyden Chemical Co.; photostatic copies of pages of articles by Dr. Spence, G. D. Kratz and A. H. Flower in various German and American trade and technical papers; and a notebook of laboratory notes belonging to H. B. Slusser of the Pocono Rubber Cloth Co., of Trenton, N. J.

Among the exhibits submitted by the defendant (National Aniline) were the following: Prof. Kraus' notes on dissociation constants of DPG and TPG; Laboratory day book of the Simplex Wire & Cable Co.; Boggs' patent No. 1,296,469; compound cards, wire samples, diary, test sheets, etc., referred to by Boggs; Spence memo book and Patent 1,235,950; compound cards of Diamond Rubber Co.; various sheets and data records of Kent, Parsons and Slusser; Decision in Dovan-Corona suit; Weiss patents 1,411,231 and 1,422,506; Hoffmann & Gottlob patents 1,126,469, 1,149,580 and 1,130,903; Price patent 1,184,015 and Caro patent No. 204,796 granted June 11, 1878; various English, French, Belgian and German patents to show the prior state of the art; list of dissociation constants and title pages and pages from several text books.

Objects of Suit

In his opening address for the Grasselli Chemical Co., Attorney Warfield stated that the plaintiff relied on claims 1 and 4 of the patent suit. The first claim concerns the process of producing vulcanized rubber, which comprises incorporating small amounts of ammonium compound having a dissociation constant greater than 1×10^{-4} and having a basic reaction at vulcanizing temperatures and heating the resulting product with a vulcanizing agent to effect vulcanization.

"We shall show," said Mr. Warfield, "that this process is certainly an outstanding landmark of that art since the discovery of vulcanization by Goodyear in 1830. It is the first invention since the days of Goodyear which may proper-

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ly be compared in its commercial results with the Goodyear invention". This was followed by a history of the patent in suit which was issued to the Synthetic Patents Co., and sold by the Alien Property Custodian in December, 1918, after the National Aniline and Chemical Co., had made bids and later dropped out. The Heyden Chemical Co. and Perth Amboy Chemical Works were licensed, but the latter merged with Roessler & Hasslacher. The Heyden Company, however, later cancelled its license but continued to make and sell hexa after which it was sued by Grasselli. This case was settled and Heyden stopped the manufacture of this material. Then the entrance of Dovan Chemical Co., into the field was recounted and later the entry of National Aniline. Mr. Warfield closed with the statement that the case was of far-reaching importance in the rubber industry.

National Aniline's Side of Case

In opening the case for National Aniline, Mr. Edmonds said, "In our estimation the patent in suit marks no contribution of anything that was ever of any value to any rubber chemist, any rubber manufacturer or anyone else concerned in the rubber industry. The matter of dissociation constants and the matter of the alkaline reactions at vulcanizing temperatures appear nowhere in the literature of the industry except in those instances where someone has speculated on whether or not this patent means anything."

Mr. Edmonds then reviewed briefly rubber chemistry and vulcanization and the use of accelerators and other compounding materials. The history and litigation of DPG was given and he said that neither DPG nor hexamethylenetetramine came under claims 1 and 4 of the patent in suit. Mr. Edmonds told of the use of accelerators in the old Diamond Rubber plant in 1912 where dimethylparaphenylene-diamin was used and the use of napthylamine in 1913 in the plant of the Simplex Wire & Cable Co.

Witnesses Called

The first witness called by Grasselli was JOHN YOUNG, sales manager of the Intermediates Division of the National Aniline & Chemical Co. who testified as to his duties in the sale of accelerators and the assistance which he gives rubber manufacturers in connection with the use of accelerators. He stated that he knew of the patent in suit but that manufacturers in general did not give it "very much thought." He told of the use of aniline oil and thiocarbanilide as accelerators prior to 1911 but knew of no interest in dissociation constants. Mr. Young also recounted the secrecy with which formulae were treated in rubber laboratories a number of years ago.

The next witness for the plaintiff, DR. C. A. KRAUS, professor of chemisty at Brown University, told of experiments which he had made in determining the dissociation constants of commercial and purified DPG and TPG with the following results:

DPG, commercial	8.7×10^{-4}
DPG, purified	9.4×10^{-4}
TPG, commercial	8.0×10^{-4}
TPG, purified	8.4×10^{-4}

all of which were said to be greater than 1×10^{-4}. On tests with hexa the witness had determined that the dissociation constant was 0.8×10^{-6} which was less than 1×10^{-4}.

The third witness was RESTON STEVENSON, associate professor of Physical Chemistry at the College of City of New York, who testified that both DPG and TPG are ammonium compounds and described the tests by which these substances were shown to have basic or alkaline reactions.

Following this witness, EARL T. MCCLINTOCK, secretary and treasurer of the Synthetic Patents Co., testified as to the royalties paid by the Perth Amboy Chemical Works and the Heyden Chemical Co. to the Synthetic Patents Co., on hexa, aldehyde ammonia and aldehyde derivatives containing hydrogen.

H. S. DOTY, president of the Dovan Chemical Corp., was the next witness called. He gave a history of the origin and development of the Dovan Chemical Corp., and then told of the license which his company had under the patent in suit as of July 27, 1922, and the various amounts of DPG sold in 1923, 1924 and 1925. The total royalties paid under this license to Grasselli amounted to about $57,000.

Carl Williams Called

The next witness was CARL WILLIAMS, director of the Rubber Service Dept. of Roessler & Hasslacher, who testified as to his knowledge of the license between R & H and Grasselli by which R & H was paying royalties on hexa, aldehyde ammonia and DPG. He gave statistics on the amount of Hexa sold by R & H in 1915 and 1916. After learning of the patent in suit from one of their customers, R & H made an investigation and later obtained a license from Synthetic Patents Co., effective February 1, 1917. The manufacture of aldehyde ammonia started a year after hexa and the DPG business started in 1922. He then said that R & H was still paying royalties to Grasselli on the patent in suit and that every shipment of DPG bore a stamp to the effect that the material was manufactured under license from Grasselli under the patent in suit.

Following Mr. Williams, ANDREW G. BOKER, secretary of the Dyestuff Committee of the Grasselli Chemical Co., told of the amount of royalties the plaintiff had received from Dovan, R & H Chemical Co., Perth Amboy Chemical Works and Heyden Chemical Co. on DPG, TPG, hexa and aldehyde ammonia. The total amount paid from January 1, 1919, to the end of 1925 amounted to $586,766.95, of which $90,072.32 was paid on DPG.

Tuttle on Stand

The use of hexa at the plant of the Firestone Tire & Rubber Co., in 1918, was recounted by the next witness, JOHN B. TUTTLE, consulting chemist, formerly with Firestone and the National Bureau of Standards. When questioned as to the presence of natural organic accelerators in crude rubber, as quoted from his book, *Analysis of Rubber*, Mr. Tuttle stated that he had never analyzed for that purpose but that it was a statement made by others. The accelerators, hexa, aniline and thiocarbanilide were given as the three known important accelerators in 1921.

BERNARD R. ARMOUR, president of the Heyden Chemical Co., then told about the license his company had with Grasselli from 1917 until 1924 when it was withdrawn. A suit against Heyden brought by Grasselli was later settled and Heyden then sold hexa but not under the same terms of the original license. Mr. Armour was followed by PRESTON FURMAN, sales manager of the same company, who

A Statement to Our Readers

Owing to the far-reaching importance of the Grasselli-National Aniline suit on the Hoffmann-Gottlob patent, and the great interest evidenced by rubber executives and chemists (as shown by the large attendance at the trial) THE RUBBER AGE is presenting in the accompanying report a comprehensive summary of all the testimony so that every executive and chemist who was unable to attend the trial may be fully informed as to all the details disclosed at the trial.

The magnitude of this undertaking can well be realized by our readers when we state that the trial lasted over three weeks and that the reports covered over 1,200 pages of testimony. In order, therefore, to present the industry with a complete summary of this vast amount of material meant the almost continual attendance of a representative of THE RUBBER AGE at the daily sessions and the necessity of consulting the testimony at such times, before and after court hours, when copies were available for inspection—a task not undertaken by any other rubber trade paper.

THE EDITOR

testified that a leading rubber manufacturer had refused to purchase hexa from the Heyden company because it was not licensed under the patent in suit.

Following the recall of Dr. Kraus, who was questioned briefly on the dissociation constants of DPG and TPG, the "prima facie" case of Grasselli ended and the defendent then put on its witnesses.

National Aniline Witnesses

The first witness put on the stand by the defendant was CHAS. R. BOGGS, factory manager of the Simplex Wire & Cable Co. Mr. Boggs' testimony covered the greater part of two days and was briefly as follows: He told of the practice from 1911 to date in processes for the manufacture of insulated wire and cable and the extent of the use of accelerators. Prior to 1913, inorganic accelerators such as litharge, lime and magnesia were used. Aniline oil was tried out in 1911 and discarded as unsatisfactory in cheap compounds. With the use of beta-napthylamine in 1913, greater tensile, elongation and better aging properties were noted and this material was therefore used in compounds for a number of years. Experiments with amines of various types led to the granting of Patent No. 1,296,469 in Mar. 4, 1919 on application filed March 16, 1914. This patent referred to the use of napthylamine and paraphenylene-diamin. Day books and the personal diary of Mr. Boggs were introduced to show dates of experiments with beta-napthylamine, sodium, amine, etc. Various Simplex factory compound cards made in 1913 were introduced to show the use of beta-naphthylamine and paraphenylene-diamin in compounds of the company at that time, and samples of insulated wires compounded with these two materials were offered in evidence.

Mr. Boggs' testimony continued on Friday, February 19, a summary of which follows:

Further tests with these two materials were made in 1914 and a sample of paraphenylene-diamin purchased in 1913 was submitted as evidence. On cross-examination, Mr. Boggs told of the discontinuance of the use of beta-napthylamine after several years because the company had gradually developed other accelerators in the factory. He admitted that DPG has been used for the last few years. Events surrounding the Boggs' Patent No. 1,296,469 were then brought to light. Mr. Boggs then told of results obtained from experiments conducted along the lines indicated by Dr. Seidl and the use of piperidine in 1914. Further questioning continued on the methods of preparing formulae, codes used to designate various materials and the secrecy with which the code cards were treated.

The next witness was EVERETT M. H. FOLLANSBEE, chief chemist of the Simplex Wire & Cable Co. He was questioned as to the tests made in 1913 with beta-naphthylamine and various inorganic accelerators. He also furnished other information on tests made with various compounds and methods of manufacturing insulated wire.

(Continued on Next Page)

UNITED STATES PATENT OFFICE.

FRITZ HOFFMANN, OF ELBERFELD, AND KURT GOTTLOB, OF VOHWINKEL, NEAR ELBERFELD, GERMANY, ASSIGNORS TO SYNTHETIC PATENTS CO. INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

CAOUTCHOUC SUBSTANCE AND VULCANIZATION PRODUCT THEREOF.

1,149,580. Specification of Letters Patent. Patented Aug. 10, 1915.

No. drawing. Application filed July 31, 1914. Serial No. 854,343

To all whom it may concern:

Be it known that we, FRITZ HOFFMANN and KURT GOTTLOB, doctors of philosophy, chemists, citizens of the German Empire, residents at, respectively, Elberfeld and Vohwinkel near Elberfeld, Germany, have invented new and useful Improvements in New Caoutchouc Substances and Vulcanization Products Thereof, of which the following is a specification.

In Patents 1,081,613 and 1,081,614 there are described new caoutchouc substances and the vulcanization products thereof, which are obtained by treatment of the auto-polymerization product of beta-gamma-dimethylerythrene with basic substances and by vulcanization of the resulting products.

In application Serial Nos. 795,505 and 795,506, filed October 16, 1913, there are described new caoutchouc substances and the vulcanization products thereof, which are obtained by the treatment of natural and synthetic caoutchouc substances with open carbon chain bases or closed carbon chain bases and by vulcanization of the resulting products. It has now been found that similar improved results can be obtained by the use of other bases having a dissociation constant greater than 1×10^{-8} and which show an alkaline reaction at the vulcanization temperature, among which may be mentioned ammonia compounds and derivatives, both inorganic and organic, such as sodium amid and borate of ammonia, aromatic diamins such as para-phenylene-diamin and naphthylamin, the quaternary ammonium bases, benzylamid, aldehyde-ammonia or the products of condensation of ammonia with aldehydes such as formaldehyde, acetaldehyde, benzaldehydes, etc. *e. g.* hexamethylenetetramin and the other methyleneamins, etc. These compounds have normally a basic reaction, or show an alkaline reaction at the temperature of vulcanization. Only a small amount of the basic compound is necessary, *e. g.* about 1 per cent.

In the process of the present invention a small amount of the base is incorporated with caoutchouc either before or at the time when sulfur or other vulcanizing agents are added and before vulcanization. Thereafter vulcanization is effected. The vulcanization process is thereby materially shortened and promoted and proceeds more smoothly. The base remains either physically or chemically combined in the vulcanized caoutchouc product. Both soft and hard vulcanized products can be obtained.

The rubber or caoutchouc used in the process of the present invention may be either natural or synthetic such as the natural Para-rubber, plantation rubber, etc., or the polymerization products of erythrene, isoprene, beta-gamma-dimethylerythrene, etc. The process of the present invention is accordingly of general application, being modified, however, somewhat by the presence or absence of nitrogenous and other substances which are normally present in natural rubber.

The following examples further illustrate the novel process and the production of the novel products of the present invention.

Example 1: 100 parts of isoprene caoutchouc is mixed with 10 parts of sulfur and 2 parts of para-phenylenediamin, and heated in a vulcanizing press for 30 minutes at 3 atmospheres pressure. The product is completely vulcanized. Without the addition of the base the vulcanization process would normally take more than four times as long a time for its completion. The product made with the paraphenylenediamin contains this base combined either physically or chemically therein.

Example 2: 100 parts of Para-caoutchouc is mixed with 10 parts of sulphur and 1 part of aldehyde-ammonia (the product of addition of acetaldehyde and ammonia) and heated to 130—135° C. for one-half hour at 3 atmospheres pressure. The material is well vulcanized. Without this addition about 4 times as much time would be required. The aldehyde-ammonia remains in the resulting product in a state of combination, probably partly or wholly chemical, although it is not desired to limit the process or product by any theoretical explanation.

Example 3: If in the process of Example 2 sodium amid is substituted for the aldehyde-ammonia in corresponding amount, a similar result is obtainel.

Instead of the caoutchouc mentioned in the above examples, caoutchoucs of other origins or compositions can be used, such as plantation rubber, normal synthetic caoutchouc or the polymerization products of erythrene, beta-gamma-dimethylerythrene, etc. In a similar manner the autopolymerization products of beta-gamma-dimethylbutadiene (Kondakow, *J. pr. Chemie*, 64, pp. 109—110) can be used, or the product obtained by the action of basic substances on this product (U. S. Patent 1,081,634). Similarly other bases can be used, *e. g.* ammonium borate, benzylamin, napthylenediamin, quaternary ammonium bases, etc. The addition of the bases materially shortens the usual time of vulcanization. If the process is continued for a longer time, a lower temperature can be employed, or if the process is continued at the usual temperature and for the usual time a larger combination of sulfur is effected.

We claim:—

1. The process of producing vulcanized rubber which comprises incorporating with rubber a small amount of an ammonium compound having a dissociation constant greater than $1X10^{-8}$ and having a basic reaction at the vulcanization temperature, and heating the resulting product with a vulcanizing agent to effect vulcanization.

2. The process of producing vulcanized rubber which comprises incorporating with rubber a small amount of an aldehyde ammonium compound, and heating the resulting product with a vulcanizing agent to effect vulcanization.

3. The process of producing vulcanized rubber which comprises incorporating with rubber a small amount of a compound of acetaldehyde and ammonia, and heating the resulting product with a vulcanizing agent to effect vulcanization.

4. As a new article of manufacture vulcanized rubber combined before vulcanization with a small amount of an ammonium compound having a basic reaction at the vulcanization temperature and having a dissociation constant greater than $1X10^{-8}$.

5. As a new article of manufacture vulcanized rubber combined before vulcanization with a small amount of an aldehyde ammonium compound.

6. As a new article of manufacture, vulcanized rubber combined before vulcanization with a small amount of a compound of acetaldehyde and ammonia.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

FRITZ HOFFMANN. [L. S.]
KURT GOTTLOB. [L. S.]

Witnesses:
HELEN NUFER,
ALBERT NUFER.

Copy of Patent in Suit

The Grasselli Chemical Co., relied on claims 1 and 4 of this patent as covering the properties of substances such as DPG and TPG used as rubber accelerators.

David Spence on Stand

DAVID SPENCE, well-known rubber chemist was then called to the stand. Dr. Spence, in giving his education and experience in the rubber industry told of his graduation from Royal Technical College in Glasgow from which he went to Jena University in Germany and then became assistant to Prof. Benjamin Moore of the University of Liverpool, England. While there he made numerous studies on the nitrogenous constituents of rubber. In 1909, he joined the Diamond Rubber Company at the request of Mr. Marks and started the first research laboratory at that plant. Upon the merger with Goodrich, Dr. Spence became head of a similar laboratory in the Goodrich factory. In 1914 he left to take charge of manufacturing operations at the Norwalk Tire & Rubber Co. plant and in 1922 he became vice-president and general manager of that factory. At present he is connected with no rubber company.

Dr. Spence told of the use of organic accelerators at Diamond in 1910 in vulcanizing guayule and pontianac which they previously had not been able to vulcanize properly. It was observed at that time that when up-river Para was extracted in acetone the rubber lost its vulcanizing properties which led to the belief that the active ingredient of high grade rubbers which gave them vulcanizing properties gave reactions of an alkaloid or nitrogenous containing substance reaction but that these substances had not actually been isolated. This discovery led to the use of substances containing similar properties such as dimethyl-amido-aniline, diphenyl-diamin, amido-phenyl-piperdine, aniline and other similar materials.

In 1911 the Diamond Rubber Company started the manufacture of para-amido-dimethylaniline, which had been found to be the most satisfactory of all the substances tried as accelerators for guayule and pontianac. This material, stated Dr. Spence, was used by Diamond and later by Goodrich until the time when he left in 1914. He stated further that this material has been used by Goodrich and Norwalk up to this day. Dr. Spence then told of physical tests of samples cured with paraphenylene-diamin in January, 1911, which proved that "this substance resulted in very marked shortening in the time of vulcanization and also an appreciable improvement in the physical quality of the vulcanized product". Other tests with sulphur-piperidyl-thio, tetramethyl-diamine-diphenylene-thio-urea, tetramethyl-diamide-diphenyl-thio-urea during 1911 were described.

Fourth Day of Trial

Upon being recalled on February 23, Dr. Spence identified some of the original laboratory records of Diamond and gave details of the plant erected to manufacture para-amido-dimethylaniline in 1911. On cross-examination the witness was asked about the code names of accelerators used on Diamond labortory cards and the secrecy surrounding the use of various materials in compounds. A number of articles by Dr. Spence which appeared in German and American technical journals were introduced into evidence as were other papers written in collaboration with G. D. Kratz and John Young. He then concluded his testimony with an explanation of what happened when rubber was extracted with acetone.

The next witness was EVERETT MORSE, president of Simplex Wire & Cable Co. Mr. Morse testified as to the use of inorganic accelerators such as litharge before 1913 at the Simplex plant and the use of beta-naphthylamine starting in May, 1913. He verified orders placed for this latter material in 1913, for use in actual manufacturing operations. Mr. Morse then recounted the difficulties experienced in getting the Boggs' patent on the above material granted on account of interference with existing patents. On being questioned as to competitors being allowed in the Simplex factory, Mr. Morse said that previous to 1908 this practice was not allowed but thereafter such visitors were permitted through the plant and questions freely answered if the information asked for did not relate to materials which comprised the formulae for compounds.

Following Mr. Morse, ROBERT D. PARSONS, superintendent of the Columbia Chemical Div. of Pittsburgh Plate Glass Co., formerly with Diamond and Goodrich from 1908 to 1916 and 1919 to 1924 took the stand. Mr. Parsons worked in various departments of the Diamond factory and was then placed in charge of design and compounding for pneumatic tires. After

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RUBBER DIVISION OF A.C.S. HOLDS LARGEST MEETING IN ITS HISTORY

Committee Appointed at Joint Meeting of Rubber Division and Akron Section to Prepare an Accurate Statement on the Extent to Which Reclaimed is Advised

Two facts of direct importance to manufacturers of automobile tires were brought out at the joint meeting of the Division of Rubber Chemistry and the Akron Section of the American Chemical Society held at the Firestone Clubhouse in Akron, Feb. 22 and 23. The total attendance was 293, the largest ever recorded at such a convention.

Primary interest centered upon the paper presented by J. M. Bierer, chairman of the Division of Rubber Chemistry, and C. C. Davis of the Boston Woven Hose & Rubber Co. on "Reclaimed Rubber as a Substitute for New Rubber" which contended that proper compounding makes possible a more extensive use of reclaimed rubber at a big saving without sacrificing the quality of the finished product.

The co-authors of this paper disagreed with the U. S. Bureau of Standards Paper, No. 294, which discourages the use of reclaimed rubber. They declared: "It is in fact possible to compound many stocks, including tire treads, with rubber and reclaim instead of rubber alone and maintain the same quality. Where the cost of rubber and of reclaim renders such replacement economical and where the use of reclaim is not precluded because of physical or chemical requirements, the money value of the reclaim can be determined for any cost of rubber. On such a quantitative basis it becomes possible to know when and how to use rubber and reclaim to obtain the most economical stock of a desired quality."

To Prepare Statement

The spirited discussion of this paper by members resulted in the suggestion that Mr. Bierer appoint a committee to prepare an accurate statement on the extent to which the use of reclaimed is advised so that no misleading statement might appear in the technical press. Accordingly, a committee consisting of Messrs. Wiegand (chairman) and Spear was appointed. The statement was not issued up to the time THE RUBBER AGE went to press.

The second note of major importance was sounded by P. S. Shoaff of the Goodyear Tire & Rubber Co. who presented in careful detail the possibilities of using internal mixing machines for rubber stocks of a higher grade than it has hitherto been possible to mix in such machines. Recent improvements have increased cooling capacity and reduced the scorching tendency so that tougher stocks may be mixed at material savings.

It was pointed out that in the last six months the consumption of reclaimed rubber by the larger manufacturers had increased nearly 50 per cent.

Although L. E. Weber, consulting rubber chemist of New York, was unable to be present at the meeting, his paper concerning the future commercial success of synthetic rubber made from acetone from potato starch or from acetylene from calcium carbide was published and created widespread interest.

He said:

"The commercial success of synthetic rubber must depend first upon its quality being equal essentially to that of natural rubber; second, that the synthetic product must possess a uniform degree of polymerization; and third that it must be competitive in price with natural rubber. The last requirement probably will be the most difficult to meet and will develop into a conflict between the agricultural chemists and botanists working together against the chemical synthesists. Agricultural chemists have been notably successful in devising means of increasing the yields of other rubber products

(Continued on Next Page)

Recognition

On February 23rd, in Akron, a meeting of the Division of Rubber Chemistry of The American Chemical Society was held.

At this large and representative gathering, a paper was submitted from a totally impartial source.

One sentence from this Paper stands out as most important and informative:

"It is possible to compound many stocks, including tire treads, with rubber and reclaim instead of with rubber alone and maintain the same quality."

This recognition by men of eminent technical ability of the vital part which Reclaimed Rubber can take in the Rubber Industry is a gratifying vindication of the claims we have put forth for it for so many years.

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"43 Years Serving the Industry Solely as Reclaimers."

Rubber Division Meets

(Continued from Page 375)

and the chance of victory for the synthesists look slim".

Harry L. Fisher and A. E. Gray of the B. F. Goodrich Co. reviewed the recent work on shellac and rubber which apparently shows that chemical reactivity is varied by physical treatment. Hydrogenation of rubber has been brought about only through the previous action of mastication and heat, and by high dilution with solvents. Under the action of heat there is a lowering of the chemical unsaturation, the amount depending on the time and the temperature. Trichloracetic acid not only lowers the viscosity of a rubber solution but also lowers the chemical unsaturation. Mastication in air causes a lowering in the unsaturation possibly due to absorption of oxygen, but in carbon dioxide there is no change in unsaturation, although there is a decided change in the physical properties.

Ira Williams of the Grasselli Chemical Co. forwarded an interesting paper showing that light has been found to promote rapid oxidation of rubber. Ultra violet light causes the production of ozone which rapidly attacks strained rubber and causes cracking. Surface oxidation protects the rubber from the action of ozone. Rubber articles which are exposed to the sun may be prevented from cracking by catalyzing oxidation of the surface of the rubber before exposure.

Other papers of a more technical nature were presented as follows: "The Guanidine as Accelerators" by H. W. Elley and D. H. Powers of E. I. du Pont de Nemours & Co. "Furfural Derivatives as Rubber Accelerators" by John P. Trickey and G. F. Leuck of the Miner Laboratories, Chicago. "Cyclopentadiene Rubber—a new Cyclic Synthetic Polymerization Product" by H. A. Bruson, Goodyear Tire & Rubber Co. "The Effect of Accelerated Aging on the Physical Properties of Hard Rubber Compounds" by E. O. Dietrich and Harold Gray, B. F. Goodrich Co. "The Addition of Ultraviolet Light to Accelerated Aging" by F. P. Jecusco. "The Oxidation of Rubber at Various Temperatures" by Brian Mead and John C. Pope of the Massachusetts Institute of Technology. "Some Factors Influencing the Weathering of Vulcanized Rubber" by N. A. Shepard, S. Krall and H. L. Morris, Firestone Tire & Rubber Co. "The Effect of Heat on Rubber" by James K. Stewart, Firestone Tire & Rubber Co. "High and Low Stiffening Carbon Blacks" by E. B. Spear and Robert L. Moore of the Thermatomic division of the R. T. Vanderbilt Co. "Volume Changes in Rubber Sols" by W. A. Gibbons and Erdley Hazell of the U. S. Rubber Co. "A New Mechanical Test for Rubber Insulation" by C. L. Hippensteel of the Underwriters Laboratories, Chicago.

Ted Robinson, conductor of the Philosopher of Folly column in the *Cleveland Plain Dealer* spoke at the banquet Monday evening. Among the interesting guests in attendance were T. Komuro of the Yokohama Rubber Co., the Goodrich Japanese subsidiary; C. L. Parsons, secretary of the American Chemical Society; H. E. Howe, editor of *Industrial & Engineering Chemistry;* Sidney Kirkpatrick, associate editor of *Chemical & Metallurgical Engineering;* and E. L. Davies, factory manager of the Sampson Tire & Rubber Co., Compton, Calif.

(Complete abstracts of all papers read will be found elsewhere in this issue—THE EDITOR.)

Sees End of Restriction

Sir Eric Geddes, chairman of the board of directors of the Dunlop Rubber Co., upon his arrival in New York January 17, on the *Aquitania,* predicted that the Stevenson Plan would be eventually abolished. He added that he had not altered his opposition to the scheme. Sir Eric remained in the United States a week, during which time he visited the Dunlop factory in Buffalo.

To Make Rubber Flooring

The J. W. Long Rubber & Flooring Corp., Brooklyn, N. Y., was recently chartered to manufacture rubber flooring. Authorized capital is 300 shares of preferred stock of $100 par value and 200 shares of common stock of no par value. Incorporators are James W. Lont, 942 Gravesend Ave., Brooklyn; Leonard Jones, 502 Tenth St., Brooklyn; and V. A. Pascal, 27 Cedar St., New York. I. L. Broadwin, 27 Cedar St., New York, is attorney for the corporation.

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TIRE FABRIC SALES SLOW DUE TO PRODUCTION CURTAILMENTS IN AKRON

Akron Factories Now Manufacturing Approximately 100,000 Casings a Day, Compared to 120,000 Around the First of the Year—Footwear and Mechanicals Active

Reports from the Akron district tell of a sharp decline in the sales of tire fabrics within the past few weeks, accompanied by a 10 per cent curtailment in tire production in the same period. At this writing, daily tire production is approximately 100,000 casings, compared to 120,000 in December and early January. The curtailment is said to be due largely to dullness in the retail trade.

According to fabric mill officials, cotton men are finding it almost impossible to obtain orders from tire manufacturers further ahead than July 1, and although the industry expects no change in good business conditions during the first half of the year, the latter part of 1926 is being viewed by some with caution, according to the Akron correspondent of *The Journal of Commerce*.

The larger tire manufacturers, such as the Goodyear Tire & Rubber Co., the Firestone Tire & Rubber Co., the B. F. Goodrich Co., and the Miller Rubber Co., as well as their smaller competitors, have been compelled to curtail tire production. The larger plants are now operating on a five-day-a-week basis, with a considerable reduction in night shifts. With the exception of the General Tire & Rubber Co. and a few others, the smaller factories are operating on three or four-day-a-week schedules.

The recent decrease of from three and one-half to 10 per cent in tire prices has not been of as much benefit to retail sales as was expected, and the protection extended dealers against possible losses from further price reductions on spring stock orders has not greatly stimulated dealer buying. Large inventories are said to be impossible with many of the dealers because of lack of adequate capital, and due to the high cost of tires, dealers have not been willing to order large stocks.

Manufacturers Well Stocked

The beginning of February found tire manufacturers fairly well stocked with finished goods, tire yarn, crude rubber and other raw materials. The manufacturers availed themselves of the comparatively low price of cotton materials in obtaining a great part of their fabric requirements for February and March.

Fluctuation in the crude rubber market is also blamed for the fact that tire dealers are purchasing tires on a strict basis of supply and demand. The uncertainty also applies to commercial accounts.

A decline also is noticed in original equipment business since the beginning of the year. The automobile manufacturers have not bought as heavily as they usually do because of a fairly good stock-up in December. Much of their January and February requirements were bought at that time in anticipation of an increase in price on original equipment.

Weather conditions, a prolonged and severe winter, are factors in curtailing a consumer demand for tires, it is also pointed out.

A tendency among rubber company buyers to "shop around" before orders are placed for substantial quantities of fabric is becoming noticeable. One textile mill, in order to move the on-hand stocks, frequently will underbid from a fraction to several cents a price quoted by another.

Leading tire manufacturers say they see nothing alarming in the present situation, however. They think that reserve stocks of tires stored in warehouses, more recently than last year, will soon be depleted, when the motoring season gets under way.

A price reduction is expected some time next month by the trade. Tire company executives, however, say another price readjustment is not planned in the

(Continued on Next Page)

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SUPREX CLAY

Maximum Re-enforcing Value at Minimum Volume Cost.

Prompt and uniform shipments of this superfine clay pigment are now available.

Carefully refined exclusively for rubber compounding, SUPREX CLAY may be relied upon for the maximum re-enforcing effect obtainable from this class of pigment.

SUPREX CLAY carries the full guarantee of compounding uniformity which has made

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ARROW BLACK

The Highest Standard Gas Black of the Rubber Industry

J. M. HUBER, Inc.

Distributors of High Quality Pigments for Rubber Manufacture

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PARIS
ANTWERP
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PRODUCTION CUTS HURT SALES OF TIRE FABRICS

(Continued from Page 377)

near future. A further reduction seems almost certain if crude rubber prices continue to hover around 55c. a pound or continue their downward trend.

Better conditions prevail in the departments making rubber hose, belting, mechanical goods, and footwear. The demand for these lines is large and in some instances production has been increased to fill orders. While increased activities in other industries have stimulated the use of mechanical rubber goods, a heavy snow fall this winter has caused a spurt in the sales of footwear, surpassing those of last year.

Cotton mills supplying a special kind of fabric for the manufacture of mechanical goods are said to be working full time to meet the demands of the rubber companies.

Fabric brokers and mill representatives in Akron declare that there has been a noticeable price cutting by textile companies in efforts to secure a share of the small business available at the present time.

A source of annoyance for fabric brokers and dealers is the credit situation. The working capital of a number of tire companies has been considerably crippled by the necessity of placing large sums of money in high priced crude rubber inventories.

It is explained that a car of rubber which formerly could be financed for $10,000 now requires an expenditure of nearly $50,000. When this condition is topped off by the manufacturer paying more than $10,000 for a car of ordinary cord tire fabric, in addition to an outlay for chemicals and other materials, the total raw material cost becomes a serious matter. Consequently, the credit of firms not exceptionally strong is apt to become strained to the breaking point.

$10,000 "RAINCOAT" FOR GRIDIRON

The University of Illinois recently announced the purchase of a $10,000 "raincoat" for the football gridiron of Memorial Stadium. The covering, which is said to be the first gridiron cover ever made, will be in four sections, laced together with quarter-inch hemp. It is to be manufactured in Newburgh, N. Y., of a rubberized fabric. Playing on the Illinois gridiron in wet weather has been difficult because it is of prairie gumbo.

Lawson Plans New Factory

The Lawson Rubber & Mfg. Co., Dallas, Texas, manufacturers of tire patches and other rubber specialties, including reclaimed rubber, has taken over a tract of land near Beckley Ave., 15 acres in area and plans the erection of a new factory. Three buildings with a total floor area of 650,000 square feet, estimated to cost in excess of $250,000, with machinery, will be erected in the near future.

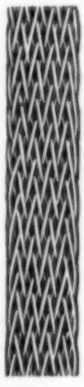
SCRAP RUBBER MEN TO MEET MARCH 15 IN N. Y.

A meeting of the Scrap Rubber Division of the National Association of Waste Material Dealers will be held March 15 at 11:30 a. m. in the Hotel Astor, New York. At the meeting a chairman for the year ending March 24, 1927, will be elected and other matters of interest to scrap rubber dealers will be discussed. E. B. Friedlander, of the Lowenthal Co., Chicago, chairman of the Division, will preside.

The 13th annual meeting of the Association will be held at the Hotel Astor on March 17 at 10:30 a. m. A president, 15 directors to serve for two years and one director to serve for one year will be elected at this meeting. The 13th annual banquet of the Association will be held at the Astor on the evening of March 15. The Association is taking the grand ballroom for the first time and expects to completely fill it.

Dunlop in Safety Contest

The Dunlop Tire & Rubber Corp., Buffalo, N. Y., has set out to break the record of a steel mill for 115 days free from accidents. So far this year, the safety committee boasts that it has not had a lost-day mishap, and that the old record of 33 days without accidents has been broken. Employees at the Dunlop plant are enthusiastic over the proposal to beat the steel mill record and are cooperating with the management in an effort to eliminate accidents.



Perfect Beads

Entire freedom from bead trouble in the construction of straight side tires is assured by the use of either National "(Patent)" High Tensile Strength, Flat Woven, Bead Braid or our new (Pratt Patent) Bead Cables. These cables, made to dimensions specified, have seven strands, yet only one piece of wire is used without soldered, welded or brazed joint.

Write for working samples of either National flat braid or Pratt cables (no charge to tire manufacturers) and full information as to our products and service.

Our engineering department tests beads and furnishes complete confidential reports as to their stretch, set and bursting point, without charge. Inquiries solicited regarding this special service.

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THE I. B. KLEINERT RUBBER CO.
is Headquarters for

Dress Shields	Reducing Garments	Powder Puff Pockets
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RECLAIMED RUBBER

Grey—Black—Red

We Specialize in Fine Reclaimed Rubbers.

Your Inquiry Is Solicited.

THE DEFIANCE RUBBER CO.
Defiance, Ohio

GOODRICH REPORTS NET PROFITS OF $12,744,447

The report of the B. F. Goodrich Company, Akron, for 1925 shows net sales of $136,239,526, against $109,817,685 in 1924. After allowing for all expenses and reserves for depreciation, interest and taxes, and a special reserve of $4,000,000 to cover possible losses due to fluctuations in crude rubber prices, the company reported net profit of $12,744,447, against $8,822,504 in 1924.

The net profit, after allowing for preferred dividends, was equal to $17.33 a share on the 601,560 shares of no par value common stock. This compares with $10.57 a share on 601,400 shares in 1924.

The consolidated income account for 1925 and 1924 follows:

	1925.	1924.
Net sales	$136,239,526	$109,817,685
Manufacturing exp.	113,860,422	95,952,161
Profit	$22,379,104	$13,865,524
Other income	1,020,035	865,642
Total income	$23,299,139	$14,731,166
Depreciation	2,377,192	2,547,434
Interest, etc.	1,927,500	2,361,228
Federal taxes	2,350,000	.....
Reserve	*4,000,000	1,000,000
Net profit	$12,744,447	$8,822,504
Preferred dividends	2,314,620	2,460,150
Common dividends	1,202,800	.....
Surplus	$9,227,027	$6,362,354
Earned surplus	24,770,124	17,609,966

*Set up for contingencies and to cover possible losses due to fluctuation in prices of raw materials.

The consolidated balance sheet on Dec. 31, 1925, showed inventories valued at $41,579,760, against $19,921,765; accounts and notes receivable $21,723,568, against $20,017,096, and cash amounting to $4,412,690, against $4,037,454. Current liabilities included $8,865,574 accounts payable, against $2,524,882; $965,649 bills payable, against $124,950; notes payable $6,500,000, against none the previous year; Federal tax reserves $2,350,000. Total assets were valued by the company at $108,991,942, against $84,885,891 at the close of 1924.

Elmdorf Visits Coast

A. R. Elmdorf, general credit manager of the Kelly-Springfield Tire Co., who is now visiting the Pacific Coast for the first time in three years, says that the present year will be the biggest in the history of his company. He declared that credits and collections in California are above normal.

R & H "50" Announced

The Roessler & Hasslacher Chemical Co., New York, recently announced an important addition to their line of accelerators. The new accelerator, which is called R & H "50", is a moderate speed accelerator and will not fuse on long standing. Softening point is 80° C. R & H "50" is a dark brown powder which works well in high zinc stocks, low zinc stocks, tread stocks, shoddy stocks, with mineral rubber and with almost any mechanical goods stock. It does not scorch, will not stick to rolls, is said not only to give uniform results over long ranges of cure, but is claimed to be the safest of resin accelerators. The new accelerator may be used at high or low steam pressure, and has no odor or toxic effect. It comes packed in 100 lb. galvanized iron drums.

Cook Remembers Hospitals

The Mercer, McKinley and St. Francis hospitals in Trenton, N. J. are bequeathed $10,000 each in the will of George R. Cook, president of the Acme Rubber Mfg. Co., Combination Rubber Mfg. Co., and Hamilton Rubber Mfg. Co., all located in Trenton. Mr. Cook died at Camden, S.C. He also left $25,000 to the Camden (S.C.) Hospital. The balance of the estate, which is said to be about $3,000,000, was left to his widow and three children.

FIRESTONE, JR. TO STUDY PHILIPPINE PROSPECTS

Harvey Firestone, Jr., en route to Liberia by way of Singapore, has postponed his departure, scheduled for February 20, in order to visit rubber growing areas of the Philippines. After several interviews with Gov. Gen. Leonard Wood, who urged him to investigate the possibilities, Mr. Firestone decided to visit Mindanao province and other regions where rubber can be grown profitably.

Mr. Firestone intimates that there must be a change in the land laws of the Philippines to enable corporations to acquire more than 3,500 acres before his company would embark upon rubber growing in the island. This change is not considered probable.

IT PAYS TO MICRONIZE

RESISTANCE

ELECTRIC cables of braided fabric were formerly used in mines, mills and factories under more severe conditions than they were made to withstand. Poor service inevitably resulted. Now rubber covered cable has proven best for this purpose. It is unaffected by scraping, dragging and straining or the destructive action of water, oil or acids.

Such rubber covered cable is supreme if compounded with sufficient percentage of

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The World's Standard Gas Black

which renders the cable tough and resistant to the greatest possible degree. Our service department will be glad to work with electrical cable manufacturers who wish to incorporate into their products the greatest possible resistance to wear.

Samples and quotations upon request.

Binney & Smith Co.
41 E. 42nd Street-New York City

USE OF COMPRESSED BLACK IS NOT NEW

The article in our issue of February 25th on "The Use of the Banbury Mixer in Handling Compressed Carbon Black" was somewhat misleading, in view of the fact that the impression was given that a particular grade and form of compression of a certain carbon black had been developed especially for use in the Banbury Mixer. However, the heavy compressed form of packing has been available from many sources in the trade and is one of the standard packages at this time.

The matter of interest is the fact that in large operations the use of a black with lighter compression is coming more into favor, and it is possible that the type of compression which will ultimately be most largely used will be packed somewhere between the heavy compressed and the uncompressed. This matter is being given considerable attention by the principal producers of black, and is being studied from all possible angles.

Announce New Plans

The Archer Strauss Rubber Co., manufacturers of rubberized fabrics, rubber novelties, etc., which recently acquired the business of the defunct Hodgman Rubber Co., Tuckahoe, N. Y., has announced that larger offices have been opened at 200 Fifth Ave., New York City. The plant of the Hodgman company will be discontinued and the machinery is now being removed to the factory of the Archer Strauss company at Framingham, Mass. It was said that the sales forces of both organizations have been combined, and M. B. Kaufman, president of the Archer Strauss company, now heads both companies. M. A. Sunderland will continue to handle general sales for both companies. R. C. Whiting is New York representative for the Archer Strauss company and W. G. Hyde is New York representative for the Hodgman division.

CLAPP GETS STEAM FROM LOCOMOTIVE

Following the example of the Pharis Tire & Rubber Co., which used a locomotive to supply steam at its Newark, Ohio, factory last fall, the E. H. Clapp Rubber Co., reclaimers of Boston, recently pressed a locomotive into service at its Hanover, Mass., factory. The locomotive was hired from the New York, New Haven & Hartford R.R. for two weeks, the length of time required to repair a damaged boiler.

Ajax Profits Increased

Net income of the Ajax Rubber Co., New York, in 1925, after addition of miscellaneous income and deduction of interest, depreciation, taxes, &c., was $1,005,069, against $664,128 in 1924. Gross sales were $9,868,825, against $16,516,715. Current assets as of Dec. 31, were $7,863,096 and current liabilities $1,364,375. Property account was $4,054,826, against $4,129,870, and cash $751,794, against $4,820,520. Total assets were $14,516,562, against $13,277,346.

William F. Rennie

William F. Rennie, for 18 years an employee of the B. F. Goodrich company, died Feb. 13. He was 41 years old and served in the experimental department until his fatal illness. He was prominent in the Knights Templar of Akron.

CABOT BUILDING TWO CARBON BLACK PLANTS

Two plants for the manufacture of carbon black are now under construction for Godfrey L. Cabot, Inc., Boston, Mass., according to Thomas D. Cabot. The company recently acquired by assignment the permit granted the Phillips Petroleum Co. for the erection of a carbon black plant at Eliasville, Texas, and has now under construction a plant estimated to cost approximately $400,000, with a daily capacity of 16,000 pounds. It is expected that the plant will be enlarged after completion if market conditions warrant. This plant will consume gas which is now being blown into the air at the gasoline plant of the Phillips Petroleum Co. and at other plants in the Eliasville field.

No Shortage Likely

This linkage of Godfrey L. Cabot, Inc., one of the oldest and largest manufacturers of carbon black, with the Phillips Petroleum Co., which is one of the largest manufacturers of natural gasoline in the world, indicates that there will be no shortage of future supplies of carbon black for the rubber trade.

Godfrey L. Cabot, Inc., is also building a carbon black plant, with a capacity of 8,000 pounds a day, near Caddo, Texas, in conjunction with the Humble Oil & Refining Co., the chief producing subsidiary of the Standard Oil Co. of New Jersey. The Cabot company is also making plans to expand its production in Montana.

This news comes at an opportune time because it is expected that the large pipe line which will be laid from the Monroe field in Louisiana to Baton Rouge will provide a market for the Monroe gas and further curtail the production of carbon black in that field.

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Prompt Service *Let Us Quote You*

GUAYULE RUBBER

"DURO" Brand Washed and Dried Ready for Compounding

A comparatively small percentage in a compound will make a stock run smoother on calenders and tubing machines, without depreciating the quality

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120 Broadway
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SAYS USE OF RECLAIM IN TIRES IS PRACTICAL

In reply to a statement published in the *Daily Rubber Trade* in which William O'Neil, president of the General Tire & Rubber Co., Akron, said, "Shoddy and reclaimed rubber have their use in the industry, of course, but their place is not in tires," L. J. Plumb, vice president of the U. S. Rubber Reclaiming Co., New York, wrote a reply. Mr. Plumb in his letter, said, "If the tire manufacturer is sincere in wanting to make the longest wearing tire possible, and at the same time curtail the consumption of crude rubber, it can be done through the use of reclaimed rubber. If the tire manufacturer is compelled to reduce costs, he can do so through the removal of part of the crude rubber and a substitution in its place of a high quality properly-made reclaimed rubber, and obtain excellent results.

"Such a policy serves to accomplish Mr. Hoover's aim and also Mr. Firestone's but unfortunately Mr. O'Neil does not seem to be convinced that a high quality product can be produced in such a manner. I am surprised that his engineers take the stand they do. Reclaimed, when properly incorporated and cured, does not harden the carcass and prevent its flexing, so destroying the tube, as he states. In fact, appreciable amounts are now being incorporated in inner tubes very successfully.

"What is the explanation of the large reclaimed rubber units which several of the leading tire companies have added to their equipment recently? We have all read of the increased production of reclaimed by the Firestone company. We know that the Goodyear Tire & Rubber Co. are very large buyers of scrap rubber and operate one of the biggest reclaiming plants in the country. Surely these companies are not making tires having two-thirds the wearing qualities they should have."

A Section of the New Road

India Announces Changes

The India Tire & Rubber Co., Akron, recently announced the following personnel changes: Lynn Harvey, divisional sales manager, has left for a two months trip to the Pacific Coast, J. B. Mills, special factory representative, left February 1 for Cuba. J. N. Dunlevy, who recently joined India, has become advertising manager.

NEW WOOD AND RUBBER ROAD TRIED IN LONDON

An experimental stretch of roadway, the surface of which comprises rubber and wood, has been laid on the Uxbridge Road, Acton, a suburb of London. The paving consists of the standard creosoted wooden block in which is cut a truncated triangle-shaped groove into which is inserted specially prepared rubber perforated through its center in order to afford the desired resilience. This rubber, which is inserted after the block has been coated with a special rubber solution which closes the pores of the wood without affecting its springiness, has a crown above the surface of the wood face.

According to *The Motor*, the rubber is fitted in the blocks in alternate manner, one block with a groove through its central length and the other grooved diagonally across its face. This method of laying, which is shown in the accompanying photograph, ensures a continuous and ever-bearing face, while at the same time giving it a tessellated appearance. It will be seen, therefore, that the weight of any vehicle rests on the rubber.

The rubber is stated to be impervious to varying weather conditions, oil and petrol. Impregnation of the block with rubber solution prevents absorption of moisture; thus there is no danger of swelling causing an upheaval of the surface, as with ordinary creosoted blocks.

The present experimental stretch is carrying on an average of 289,000 tons every month.

CABARRUS COTTON MILLS

M. L. CANNON
PRESIDENT & TREASURER

KANNAPOLIS, N. C.

Superior Quality Tire Fabrics

EGYPTIAN-PEELER
KARDED & COMBED
CORD & SQUARE WOVEN

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A. W. REID
Representative

KANAWHA RUBBER OPENS IN OLD DUNBAR FACTORY

The Kanawha Rubber Co. began operations March 1 in the old factory of the Dunbar Rubber Co. in Dunbar, W. Va. It is expected that 500 hands will be employed before the end of the year. The present force numbers about 40, working in three shifts. Operating a reclamation process, it is expected that the factory will use 20 tons of scrap rubber a day. For the time being, the Kanawha company will manufacture reclaimed rubber only, but later it may go into the production of tires. A grade of reclaim called "Fiberhard" was one of the first products turned out.

Officers are C. E. Seigfried, president; James White, vice president; J. S. Jones, secretary and assistant treasurer; and Edward Lory, treasurer. The board of directors is composed of the officers and Quince Jones. A. H. Marietta is factory manager and R. Cameron chief chemist and experimental engineer. The company is incorporated for $50,000.

In connection with the opening of the Kanawha company, it was stated that the Dunbar Rubber Co. was operating at capacity.

NEW FIRESTONE PARTY ENROUTE FOR LIBERIA

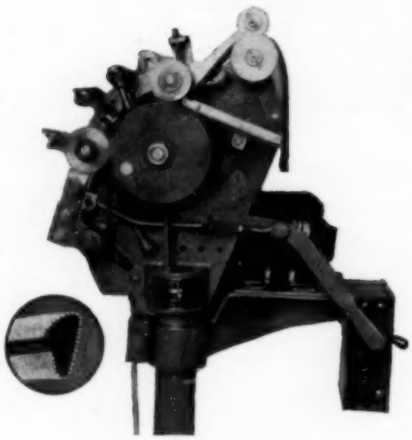
Another party, in charge of M. T. Copeland of the export department of the Firestone Tire & Rubber Co., recently sailed for Liberia, Africa, where they will work for the Firestone Plantations Co. According to reports received in Akron, between 4,000 and 5,000 negro laborers are now at work on the plantations clearing a tract of 20,000 acres. The labor forces are being increased as rapidly as possible. The company now has 2,000 acres under cultivation.

A new economic and commercial freedom is visioned by Mr. Firestone in his plans for rubber-growing on a big scale in Liberia. Under the terms of the agreements entered into with the Government of Liberia, Mr. Firestone got a lease for ninety-nine years on 1,000,000 acres of land most suitable for the production of crude rubber; and an arrangement for the general public improvement of the country, such as the construction of port and harbor facilities, roads, hospitals, sanitation, lines of communications and development of hydro-electric power.

Cost of reclaiming the African jungle and bringing rubber into bearing in Liberia is expected to be a minimum of $100 an acre, or a total of $100,000,000 to develop the lease, according to the opinion of experts.

To operate such a development at capacity will require 350,000 native laborers. The 1,000,000 acres would then produce approximately 200,000 tons of rubber, or almost 50 per cent of the total amount produced today.

Covering Machine for Raw-Formed Clincher Beads



"Utility" Bead Covering Machine

The picture herewith shows a machine recently developed, which will cover a raw tubed-to-shape clincher bead. The covering can be frictioned on one side, or both as desired, and this machine laps it around the bead, leaving a small gap in the fabric cover at the point of overflow. (The small circular insert shows a cross-section of the bead with the gap in the fabric which is closed during the molding process.) The overflow, when molded, is all rubber and not rubber and fabric as is the general practice.

The customary method for using this machine is to place it in front of a tube machine. The stock is tubed to shape and passed through a cooling tank and then to the Utility covering machine in a continuous length, and then is wound on a reel ready for leading into the molds. (Utility Mfg. Co., Cudahy, Wis.)

Aero Brand
DPG
DIPHENYLGUANIDINE
DOTG
DIORTHO-TOLYLGUANIDINE
The two most popular guanidine accelerators, made by the same process from basic raw materials which we control. Highest purity and uniform quality.
Stocks of Aero Brand DPG are carried at Warners, New Jersey; Akron, Ohio; San Francisco, and Azusa, California; Montreal and Toronto, Canada; and London, England.
DOTG is carried at Warners, New Jersey, only.
Address all communications to New York Offices
AMERICAN CYANAMID CO.
511 FIFTH AVENUE NEW YORK, N.Y.

Rubber Substitutes
WECCO
ALL GRADES
SAMPLES FURNISHED
MANUFACTURED BY
THE WESTMINSTER CHEMICAL COMPANY
531 South Peoria St., CHICAGO

MILLER REPORTS NET PROFITS OF $3,533,201

With net operating profits of $3,533,201, the Miller Rubber Co., Akron, Ohio, ended the year 1925 in a very satisfactory financial condition. This net is after provision of $1,127,038 for depreciation, $510,000 for Federal taxes and after deducting interest and all other charges.

From the net profits $860,569 was set aside toward the establishment of a 1,500,000 contingent reserve and the balance of $2,672,632 carried to surplus. Preferred stock dividends amounted to $542,591 and comomn dividends declared or paid $364,053. From surplus was also taken $3,449 in connection with premium on the retirement of preferred stock leaving the surplus account charged with $3,879,561 on December 31. During the year $4,000,000 of previously authorized preferred stock was issued and the proceeds used to bolster the working capital.

"We have closed the year with efficient operations in all departments of our business," said Jacob Pfeiffer, president. "Sales volume showed a splendid increase over the previous year. Our financial position is very satisfactory, current assets amount to $14,085,490, including $1,280,087 cash. The Company had no obligations to banks for borrowed money at December 31, 1925."

May Open Wildman Plant

Sidney J. Tennant, vice president of the Wildman Rubber Co., Bay City, Mich., stated recently that prospects for the company finally getting into production are very bright. He said that it will require $231,000 to complete and equip the factory for operation, and a sound plan has been drawn up for raising $500,000 which will also provide working capital. Gross assets of the company are said to be $968,725.

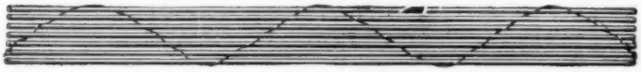
The liabilities consist of notes payable $5,500; accounts payable, $28,827.72; interest, $1,124.72; taxes, $4,020.76; subscribers equity in stock on incomplete contracts, $39,252.19; and preferred capital stock issued, $890,000. In addition 26,243 shares of common stock are out.

URGES INDUSTRIAL AID FOR CRUDE PLANTATIONS

The great oil, automotive and rubber manufacturing industries must unite in a spirit of service to the country to obtain an equitable share in the plantation rubber industry, Edgar B. Davis, president of the United North & South Oil Co. and former senior vice president of the United States Rubber Co., said in an address before the Kiwanis Club at Brockton, Mass. March 2.

Mr. Davis broke a public silence, of 19 years to speak at an assembly in his native city. He recently returned from an extended tour of the East which covered all of the rubber plantation territory and a large area where the industry might be established feasibly. He was accompanied by David M. Frigart, who was designated by Secretary Hoover as a special agent of the Department of Commerce to make the survey.

Mr. Davis urged co-operation of the interested industries to secure a fair part of the rubber plantation industry.



—*for* better tire beads *at less cost*

—a new Flat Tape for bead construction that adds to the strength and anchoring qualities of the bead—and at a saving of approximately 2c to 8c per tire.

"ACCO" Flat Tape can be made of any size or tensile wire—yet smaller in cross section as the wires lie flat and parallel, equalizing the tension. The wires are held in place by a fine filler wire.

Let us show you how this construction can add to the efficiency of your tires. Our engineers will gladly make specific recommendations without obligation to you. Write us today.

AMERICAN CHAIN COMPANY, *Inc.*
BRIDGEPORT CONNECTICUT
In Canada:
Dominion Chain Co., Limited, Niagara Falls, Ont.

"ACCO" Flat Tape
for
Straight Side Tire Beads

WHITING

Domestic

SUPERFINE

Snow-White

300 mesh

A *quality* product
at moderate price

WM. S. GRAY & CO.
342 Madison Ave.
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INTERNATIONAL PULP CO., *41 Park Row, New York, N. Y.*
SOLE PRODUCERS OF PURE ASBESTINE SPECIALLY PREPARED FOR USE IN RUBBER
Covered and Protected by Letters Patent Registered at U. S. Patent Office, Washington, D. C.
LIBERAL WORKING SAMPLE FURNISHED FREE

SAY 1926 PRODUCTION WILL BE 646,000 TONS

(*Special to* THE RUBBER AGE)

In their annual review of the rubber market S. Figgis & Co., London brokers, state that the chief feature of 1925 was the greatly increased consumption, which they estimate at 560,000 tons, an increase of 90,000 tons on 1924. The review refers to the fact that America constructed a further 4,000,000 cars during 1925. A considerable factor in the advance of consumption, it adds, was the large number of omnibuses fitted with giant pneumatic tires which America brought into use at the rate of an extra 1,000 buses per week.

Regarding production, the shipments of plantation rubber from Ceylon, Burma, Malaya, Sumatra, Borneo, and Java are estimated at 477,000 tons in 1924 and 366,000 tons in 1922. Dry rubber from the Dutch Indies is put at 187,000 tons, in which connection the increased output of the voluntarily restricted British-owned estates toward the end of the year is referred to.

With regard to the production of plantation rubber for 1926 the firm estimates a total, assuming similar tapping conditions and 100 per cent of standard from the restricted areas, of 606,000 tons, which would bring the total production, including 40,000 tons wild, up to 646,000 tons.

It is not thought that the restricted areas can produce in 1926 more than 95 per cent of the standard allowance, which would reduce the quantity by 17,500 tons and make the total 628,000 tons. It is important to remember that the whole of this output will not reach the consuming market until 1917. Arrivals in 1926 in consuming countries are estimated at 620,000 tons. This very large total, it is stated, will always be wanted if consumption continues at the same rate of increase as in 1925. High prices, however, may affect consumption and reclaimed rubber will be more largely used in future. The probable output of dry rubber from Dutch territories, including British-owned, is given as 220,000 tons (against 187,000 tons last year).

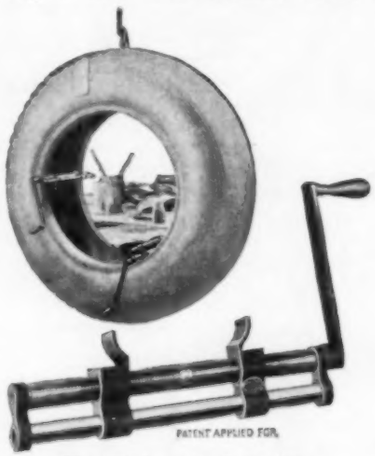
Canton Factories Busy

The Triangle Tire & Rubber Co., Canton, Ohio, recently increased production of truck and bus tires; passenger car tire production continues at 400 a day, approximately 50 per cent of which are balloons. "We expect present production to continue through the balance of February," said M. C. Wyatt, general manager. "Our first year which ended December 31, was a remarkable one." Little change in the production schedule is reported by the Tuscan Tire & Rubber Co., Carrollton, Ohio. The factory plans to increase production March 15; the drug sundries department continues to operate at capacity.

Production at the Monarch Tire & Rubber Co., Hartville, near Canton, continues at 350 tires a day. January was said to be the biggest month in the history of the Milestone Tire & Rubber Co., East Liverpool, Ohio. Prospects are that February will prove to be even a better month. The company specializes in Ford sizes.

WADSWORTH SPREADER HELPFUL IN REPAIRING

To open up a big pneumatic casing for inspection or repair has always been one of the toughest jobs in any shop where tires are handled. The old method of prying the beads apart by force and inserting a wood block between the beads



The Wadsworth Spreader

now gives way to a more scientific method. A convenient, easily operated, inexpensive hand tool for the purpose is the Wadsworth Heavy Duty Tire Spreader in which two bead hooks are spread on a right and left thread by simply turning a crank. They are sold and used in pairs. With a spread of from two to twelve inches any pneumatic truck tire can be spread open and held securely while internal repair is being made. The entire inside surface is clear for buffing, cleaning and cementing.

When the job is ready to be released, simply turning the handle backward allows the beads to come together gradually until the spreader can be removed. There is no danger of the tool letting go suddenly and injuring the user. Made of malleable castings except the spreader screws and guide bars which are of cold drawn steel, these tools are practically indestructible. They are made by the Wadsworth Core Machine & Equipment Company, Akron, Ohio.

Los Angeles to Save Tires

The Los Angeles Motor Car Dealers' Association recently started a campaign to instruct motorists to get more mileage out of their tires. Letters were sent to all members with the request that they instruct their customers to examine their wheels to make sure that they are not out of alignment, maintain proper air pressure, make repairs promptly and take other precautions to save their tires. The campaign is in line with Secretary Hoover's efforts to reduce crude rubber consumption and thereby bring down prices.

FELLOWSHIP OFFERED BY AKRON UNIVERSITY

During the school year 1926-27 there will be offered at the Municipal University of Akron, Akron, Ohio, two fellowships in the study of rubber chemistry. These fellowships are given by the Goodyear Tire & Rubber Co. and the Firestone Tire & Rubber Co. and each pays $1,000 and carries exemption from all fees and charges. The fellowships are open to men who have been graduated from first grade chemical courses in American colleges.

The applicant must agree to devote a maximum of nine hours a week as an assistant in the department of chemistry at the Municipal University of Akron and to give the first option of his services for at least a year to the company awarding the fellowship. He must have a bachelor's degree and must have successfully completed the following under-graduate courses: general inorganic chemistry, qualitative analysis, quantitative analysis, organic chemistry and physical chemistry.

Intercontinental Profit

The financial statement of the Intercontinental Rubber Co. for the year ended Dec. 31, 1925, shows a net profit of $917,853, after depreciation charges and Federal taxes. The final charter of the year was partly estimated. Operating profits were $1,380,193, and net, before interest and income taxes, was $1,177,344. Interest was placed at $43,240, and Federal income taxes estimated at $116,250. The company produced 8,108,500 pounds of rubber last year, according to the report, is now expanding its plantations to the United States, notably California, where it is believed guayule can be grown successfully.

A Correction

We wish to correct a typograhical error appearing in Table 1, Page 316 of the article concerning Para-Flux furnished by the C. P. Hall Co., Akron, in our issue of Feb. 10. The maximum tensile strength in pounds of pine tar as a softener should have read 3550 instead of 2550.

Du Pont Announces Changes

The dyestuffs department of E. I. Du Pont de Nemours & Co., Wilmington, Del., recently announced the appointment of F. W. Wolff as sales manager of intermediates and rubber chemicals and of W. W. Rhodes as sales manager of agricultural and miscellaneous chemicals. Messrs. Wolff and Rhodes have been with the Du Pont company for many years. Their offices are located in the Du Pont Bldg., Wilmington.

H. H. Henderson Moves

H. H. Henderson, Inc., crude rubber brokers, moved February 10 from the Singer Bldg. to the Cotton Exchange Bldg., 60 Beaver St., New York.

NATIONAL STANDARD CO. OFFERS COMMON STOCK

The National Standard Co., Niles, Mich., recently offered through Shields & Co., New York and John Burnham & Co., Inc., Chicago, 110,000 shares of no par value common stock. The company was originally organized as the National Cable & Mfg. Co. in 1907 at Niles and in the early part of 1913 acquired the business and assets of the Cook Standard Tool Co., Kalamazoo, Mich., and changed the name to the National Standard Co.

The principal products of the company are wire braids, woven wire tapes and steel cables used in the manufacture of tires as an integral part of the bead of straight side casings to give them the rigidity necessary to firmly hold the tire on the rim. A substantial volume of business has also been built up in the manufacture and distribution of a line of garage equipment, wrecking cranes, creepers and jacks of various types.

Principal plants are located at Niles, Mich. and Akron, Ohio. Canadian operations are handled through a subsidiary, the National Standard Co. of Canada, Ltd., located at Guelph, Ontario, all of the stock being owned by the Michigan corporation. The three factories contain over 160,000 square feet of floor space. On an average, about 200 operators are employed, supplemented by an adequate sales and engineering force.

Of 104 companies manufacturing automobile tires in the United States, the National Standard Co. supplies bead material to all but six. And four of these six companies have their own facilities.

The balance sheet, as of Sept. 30, 1925, with only a nominal value of $1.00 for good will, trade names, etc., shows a net worth of over $2,166,000 and a net working capital of over $1,000,000. According to a letter sent by W. F. Harrah, president, to the bankers, the company has made a profit from operations in every year since its inception. The net earnings for the past four years, ended Sept. 30, 1925, after taxes, depreciation and all charges, have averaged over $567,000, equivalent to $3.78 per share on the present capitalization of 150,000 shares, and for the last year were over $764,000, equivalent to $5.09 per share of this stock.

The stock pays dividends of $2.50 per annum. A quarterly dividend of $0.62½ a share is payable April 1, 1926, to stockholders of record March 22. The stock offered is being purchased from individuals and involves no new financing for the company. The company has no bonded indebtedness, bank debt or preferred stock. Stock is being offered at $28.50 a share.

Brokers Incorporate

The Avia Company, Inc., New York, was recently granted a charter to deal in crude rubber. Authorized capital is $50,000. Incorporators are Louis V. Keeler, Charles W. Walters, both of 89 Broad St.; and William S. Siemon, 49 Wall St.

RUBBER EXHIBIT SHOWN AT N. J. STATE MUSEUM

An interesting exhibit on the crude rubber plantation industry is attracting many visitors to the New Jersey State Museum at Trenton. An exhibit on Liberia is composed of pictures and articles illustrating the life, beliefs, manners and customs of the people, as well as the industrial features of the country. The whole crude rubber exhibit is divided into two sections, the first showing wild rubbers from different sections of South America, Central America, India and Africa. The other section includes plantations rubbers.

Pictures and diagrams explained the source of a great deal of our rubber and show how the trees are tapped. The coagulation of latex by the acid method is also being demonstrated.

Form Watertown Tire

The Watertown Tire & Rubber Co., Watertown, N. Y., was recently chartered with an authorized capital of $20,000 by the following incorporators: C. E. Olley, J. H. Martin and W. A. Fix.

Sumatra Plantations Sold

It was recently reported from London that the Sumatra rubber plantations owned by the Danish East Indies Plantation Co. had been sold to J. A. Wattie & Co., London, for 10,000,000 kroner (about $2,500,000). The deal includes 25,000 unplanted and 5,000 planted acres.

How Should Rubber be Dried?

The Rubber Shortage demands economy in crude and reclaim preparation.

Carrier Drying Systems,

including the well known Hunter Process, produce uninjured and uniformly dried stock. These Systems assure reduction in time, space, labor and milling costs.

Write for details.

Carrier Engineering Corporation

Offices and Laboratories
750 Frelinghuysen Ave., Newark, N. J.

DIAMOND
MICA

NON-METALLIC WATER GROUND

Highest Grade for Rubber Industries

Pure—finely powdered—For use in tread stocks, repairing tires, in air bags, inner tubes and various kinds of molded mechanical goods.

Desirable as it is a Toughener and Heat Resister

THE HARSHAW FULLER & GOODWIN CO.
CLEVELAND, OHIO

MILLS

Crabtree, N. C. Newdale, N. C.

Samples upon request

STOCKS CARRIED AT

Cleveland, O. Trenton, N. J. Chicago, Ill.

CALIFORNIA GOODYEAR OFFERS $5,000,000 NOTES

The Goodyear Tire & Rubber Co. of California recently offered through Dillon, Read & Co. $5,000,000 in five-year 5½ per cent sinking fund gold notes dated Feb. 15, 1926 and due Feb. 15, 1931. The notes are in denominations of $1,000. Interest is payable February 15 and August 15. They are redeemable as a whole or in part by lot on any interest date after 30 days notice at 102 and interest to and including Feb. 15, 1927; thereafter at 101 and interest to and including Feb. 15, 1929; and thereafter prior to maturity at 100½ and interest.

Goodyear Tire & Rubber Co. of California was incorporated in 1919 and operates factories in Los Angeles, selling in the western states through a wholly-owned subsidiary a line of tires, tubes, accessories and repair materials identical in construction and brand with those made by the Goodyear Tire & Rubber Co. of Akron. The California plant has more than 23 acres of floor space and has a daily capacity of 7,500 tires and 10,000 tubes.

The notes will be the direct obligation of the company, and after application of part of the proceeds will constitute its only funded debt. They are followed by $7,995,700 par value preferred stock and $4,000,000 par value common stock. Condensed consolidated balance sheet as of Dec. 31, 1925, shows tangible assets, after deduction of all reserves and liabilities except these notes, of $20,238,891. Net current assets as shown by the balance sheet amounted to $12,419,336, after deducting current liabilities of $2,256,932.

Proceeds of the notes will be used to provide additional working capital required by increased cost of crude rubber and increased volume of business, to retire $2,146,656 outstanding notes of the company and to pay the deferred dividends, amounting to $1,119,398 on preferred stock.

Gilmer Gets Accounts

The L. H. Gilmer Co., Philadelphia, has taken over a large number of unfilled contracts for small rubber belts from the United & Globe Rubber Co., Trenton, N. J., which recently went into the hands of receivers. These orders are principally for V-belts for washing machines and other household appliances.

Sealzit Tube Incorporated

A certificate of incorporation was recently filed for the Sealzit Tube Corp., which plans to manufacture rubber goods. Location of the factory in Stamford, Conn., is being considered but definite arrangements have not yet been made, according to Thomas Yeomans, one of the incorporators. The company has an authorized capital of $250,000, with $100,000 paid in. Incorporators are Thomas Yeomans, Clarence R. Hall, John T. L. Hubbard and Florence T. Bechtel. A meeting of the directors was recently held in Bridgeport.

CLASSIFIED ADVERTISING

10 cents a word, minimum charge $2.00, payable in advance.
Address replies to Box Numbers, care THE RUBBER AGE, 225 Fourth Ave., New York.

EQUIPMENT FOR SALE

Must vacate building and dispose of the following items at once: Vaughn, 66″, 3 roll Calendar Herring Bone gears, 2 speed drive; Birmingham 60″, 3 roll Calendar, silent chain drive; Thropp 16 x 42″ and 15 x 36″ mills; Adamson 6 inch tubing machine, with conveyor and motor; Thropp Horizontal Vulcanizer, with tube trolley and tracks, also other items. Louis Jacobs & Son, 1225 Flushing Ave., Brooklyn, N. Y.

Electrical equipment for immediate delivery: four 150 K.V.A. single-phase Scott connected transformers; also panel Switchboard and about 2500 feet heavy wire. Box 421, THE RUBBER AGE.

"-- or what have you?"

Do you need equipment?

Want to sell old machinery?

Need a new foreman?

Can you use a chemist?

THEN — CONSULT and USE THE RUBBER AGE ADS!

H. MUEHLSTEIN & COMPANY, Inc.

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"For Service"

NEW YORK - 41 East 42nd St.
AKRON - 111 Savings & Loan Bldg.
CHICAGO - 327 S. La Salle St.
BOSTON - 176 Federal St.

WAREHOUSES: Jersey City, N. J.

SULPHUR
FOR THE RUBBER TRADE

"TIRE" BRAND SUPERFINE Rubber Sulphur
"TUBE" BRAND VELVET Rubber Sulphur

Specify "Tire" and "Tube" Brands on your orders. This will assure you of Stauffer quality and service.

Stauffer Chemical Co.,
Houston Texas
San Francisco, Cal. Chauncey, N. Y.

The CARTER BELL MFG CO

CARTER BELL STANDARD SINCE 1903 RUBBER SUBSTITUTES

150 Nassau Street New York

MAY MAKE RUBBER TIRES COMPULSORY IN GERMANY

The Reich Traffic Department in Berlin recently rearranged automobile taxes to increase the national revenue by 100,000,000 marks and inserted clauses that make the use of rubber tires on all vehicles almost compulsory. The proportion of transportation by trucks throughout Germany is considerably greater than by private cars, and because of short hauls in the industrial districts, these trucks usually haul two or more trailers which often have only iron tires. In some cases trailers are hauled by iron-wheeled tractors.

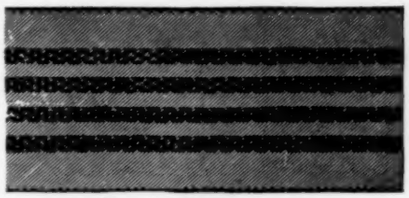
In the coming year such trailers and tractors will be taxed about $90, whereas if they are equipped with rubber tires, the tax will be only $30. Although the conversion of steel-wheeled vehicles to rubber tires will cost the owners heavily, traffic officials believe that the saving to the streets will warrant the heavy penalty on owners who do not make the change.

The new tax is expected to materially increase tire sales, and is welcomed both by manufacturers and dealers.

New Webbing Perfected

Everlastik, Inc., 1107 Broadway, New York, has perfected a new type of webbing for use as a friction-surface "curtain" for men's and boy's trousers. They have commenced an advertising campaign to the trade and consumer to popularize this material under the trademark "Snugtex", and have adopted the slogan, "Keeps Shirts Smooth and Trousers Snug".

Upward of a year was spent by Everlastik, Inc., in perfecting "Snugtex" to fill a need long felt in the clothing trade for a preventive of the bulging shirt at the waistline. The result is a webbing



How "Snugtex" Looks

fabric which has been accepted as the ideal thing for this purpose.

Threads of upriver para rubber are woven into the warp of the fabric in such a way that the threads are raised above the surface in a chain-like formation. These raised threads present a very tough, clinging surface and clutch and hold the wearer's shirt in place, even during strenuous exercise, such as golf and tennis. The material is non-stretchable.

"Snugtex" is being made in five colors —White, Pearl, Buff, Slate and Black. There are two styles—1¼" wide for use in trousers already equipped with a "curtain", which is the trimming fabric sewn around the top of the trousers, inside; and 2¾" wide, intended for use as a complete curtain.

MICHELIN PLANS HUGE FACTORY IN ENGLAND

(Special to THE RUBBER AGE*)*

A large tire factory is to be erected by the Michelin Tire Co., at Stoke-on-Trent, England. Since the directors of the company decided to establish works in England they have had under consideration a number of sites in various towns and cities, and eventually the choice lay between Nottingham and Stoke-on-Trent. Lengthy negotiations have taken place between the Stoke-on-Trent Corp. and the company, and a provisional agreement has just been reached, subject to the approval of the Michelin technical advisers.

To Cost $2,500,000

An estate will be purchased and a huge factory erected at a cost of £500,000 ($2,500,000). The site selected is known as the old racecourse, Boothen, Stoke-on-Trent, and is nearly 200 acres in extent. Manufacture is expected to begin in about twelve months' time. When completed, the factory will employ from 8,000 to 10,000 workers, 25 per cent of whom will be women. Except for the few pivotal men who will be engaged, the labor will all be unskilled, and it is hoped that practically all the unemployed in the "potteries" area will be absorbed.

The corporation has promised to erect houses for the company's workers, to supply electricity at cheap rates, and to link up the works with the London, Midland & Scottish Railway, which runs alongside.

AKRON-WILLIAMS A-W PRODUCTS

Heater Presses
Molds and Cores
Tubing Machines

THE WILLIAMS FOUNDRY & MACHINE CO
"In Business Since 1888"
AKRON, OHIO

EMBOSSING CALENDERS
For Artificial Leather, Oil Cloth, Carriage and Automobile Covers
DRYING MACHINES
with Copper or tinned iron Cylinders for Cotton Ducks, Drills and Sheetings
The Textile-Finishing Machinery Co.
OFFICE, No. 83 EXCHANGE PLACE
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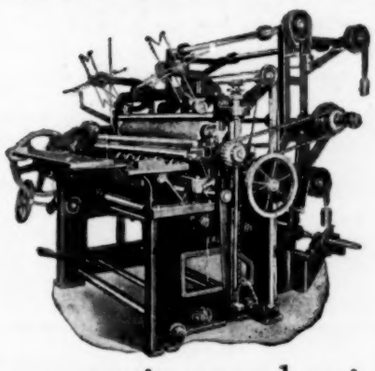
CAMACHINE 6-C



—for quantity production of all kinds of stripping used by the rubber industry. If you make, use or sell stripping, write for information to—

CAMERON MACHINE CO.,
61 Poplar St., Brooklyn, N. Y

"RUBBER FOAM" USED IN NUMEROUS NEW PRODUCTS

Rubber Foam, the only cellular rubber product ever produced and which provokes astonishing interest wherever examined for the first time, is growing rapidly in popular favor and the distributors are having difficulty in supplying the demand.

Rubber Foam, or Cauotchouc-Mousse as it is generally known, is manufactured in France and exclusively distributed by the C/M Company of America, Inc. with headquarters in Chicago. This unusual material resembles sponge rubber and here comparisons end, for it is one-fourth the weight of sponge rubber; is softer more pliant, absolutely waterproof, will never rot nor lose its resiliency. Rubber Foam is composed of the highest grade of pure rubber into which is injected a certain gas while in its molten stage, and thus inflated to the various thicknesses desired. This is done by a secret process and special machinery all of which is fully protected by patents which permit no infringement. This product comes in sheets averaging in width 36" and lengths from 90 to 240 inches, according to thickness. One will appreciate the lightness of this marvelous product when it is known that a sheet ⅜ in. thickness and 90 inches long weighs but 3½ lbs, while a sheet ⅛" 36"x240" weighs but 3 lbs.

Many Novel Applications

The uses for Rubber Foam are practically endless. Sporting goods manufacturers have adopted it as a padding for all athletic uniforms, having discovered its wonderful properties as a shock-absorber. Surgeons use it for splints and bandages and as covers for operating tables. It is used as cabin linings in passenger carrying planes to shut out the extreme noise of the motor, prevents vibration and is a protection against cold at high altitudes. Aviation suits lined with this material protect the pilot in every way and in case of a fall into the water there is no danger of drowning as the suits thus lined will keep the wearer afloat indefinitely as well as protect him against exposure. These suits weigh about six pounds and permit one to remain in the water always in an upright position.

As an insulator for refrigerators, water-coolers, ice-cream containers and soda fountains, Rubber Foam has no equal and the same can be said for its use as a sound deadener for telephone booths. It is in demand by radio manufacturers and in the manufacture of loud speakers. This product will solve many problems for industrial application by technical engineers just as soon as they become acquainted with it, and the price, considering its qualities and exclusiveness, is very moderate.

Falls Plant Completed

The Falls Rubber Co. of Akron, Inc. recently announced that the $100,000 plant improvement begun early in 1925 has been completed. The factory where Falls tires and Evergreen tubes are made is now a model of manufacturing efficiency. The Falls company has long specialized in heavy duty tires, and has made a signal success in tires for busses and trucks. New conveying systems now handle these large tires as easily as the Ford sizes. Other improved machinery to be added is a battery of new watch-case vulcanizers with temperature controls, new tire building machines and a large calender for impregnating fabric with rubber. Falls engineers recently perfected and patented a new bead making machine that insures the beads of Falls tires being uniformly covered and built. A conveyor system has been added to the inner tube department which permits both air and water tests for all Falls tubes.

McGrath Joins Corduroy

J. A. McGrath, for the last 11 years identified with tire manufacturers in the middle and far west, was recently engaged by the Corduroy Tire Co., Grand Rapids, Mich., as tire room superintendent. He has served in this capacity with other tire concerns and is a recognized authority in tire construction and up-to-date factory methods.

The Corduroy Tire Co. has started production in its recently completed addition. When this new unit is fully equipped and running to capacity it will practically double its output of tires and tubes.

GUINZBURG RE-ELECTED PRESIDENT OF KLEINERT

The I. B. Kleinert Rubber Co., New York, re-elected Victor Guinzburg as president for the year 1926 at the recent annual meeting of the board of directors. Other officers chosen are as follows: Ralph Guinzburg, vice-president; Harry I. Kleinert, second vice-president; Charles B. Mergentine, treasurer, and A. B. Salinger, secretary. Harris Wilcox was appointed sales manager for the company, and George Guinzburg was elected to the board of directors.

The employes of the Kleinert concern presented Col. H. A. Guinzburg with a handsome clock as a token of appreciation. Col. Guinzburg, whose retirement officially took effect some weeks ago, has been connected with the organization for more than 2 years. He will be succeeded by Charles B. Mergentine, who has just been appointed treasurer. Colonel Guinzburg will remain with the Kleinert organization for some time before actual retirement, it was said.

The Kleinert company is contemplating the erection of several additional factories for the spring and summer months, it was stated by Ralph Guinzburg. Several changes and promotions have been effected in the selling staff, it was announced. The road representatives for the rubber notion house have just returned from their respective territories and report good trade in various parts of the country.

It was further reported at the annual meeting that the firm's sales for January of this year had exceeded the amount of sales for the corresponding month in 1925. The company's business for 1925 showed an increase over the previous year.

M. Rothschild & Co. Formed

M. Rothschild & Co., Inc., New York City, was recently chartered to engage in crude rubber brokerage. Authorized capital is 1,000 shares of preferred stock of $100 par value and 1,000 shares of common stock of no par value. Incorporators are Marcus Rothschild, 266 Orange Road, Montclair, N. J.; and Elliot H. Simpson, 1096 Greene Ave., Brooklyn, N. Y. Spitz & Bremberger, 56 Pine St., New York, are attorneys for the new company.

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Extract from— "Uses of Factice In Proofing."

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Akron, Ohio

Hoffmann-Gottlob Patent Suit

Continued from Page 374

the Diamond-Goodrich consolidation, he was placed in charge of construction of pneumatic tires and in 1920 was development manager of solid tires. In 1921 he was sent to the French factory of Goodrich at Colombes as technical director in charge of design, compounding and construction. His testimony consisted of information on the use of thiocarbanilide and aniline at Diamond in 1908 until 1911 when aniline was discontinued but thiocarbanalide was used up to the time when Mr. Parsons left Goodrich in 1924. He testified that in 1911, and after the consolidation, para-amido-dimethylaniline was used in a master batch consisting of 5% of this material and 95% of rubber. This material was used up to 1924, Mr. Parsons stated. In regard to the use of various compounding ingredients the witness testified that he did not actually know what went into the compounds but assumed that what he was told was correct.

R. W. Kent Testifies

The next witness for the defendant was RAYMOND W. KENT, Goodyear chemist. Mr. Kent was graduated with a Master's Degree from Harvard in 1904. He was employed by Diamond Rubber Company from 1906 to 1912, by Swinehart Tire & Rubber Co. for one year, 1912-1913, then by McGraw Tire & Rubber Co. and later by Republic Rubber Co., for eight years. Mr. Kent's testimony related to the use of aniline at Diamond in 1906, thiocarbanilide in 1907 and para-amido-dimethylaniline in 1911. When he went to Swinehart in 1912 he stated that he introduced the use of thiocarbanilide at that plant, the material being made in the factory laboratory. He later sought para-amido-dimethylaniline and order a kilo from National Aniline & Chemical Co., for $16 a pound but upon being refused by his company, Mr. Kent left its employ. He then produced a record sheet showing Diamond compounds containing references to use of para-amido-dimethylaniline, thiocarbanalide and aniline.

Fifth Day of Trial

Mr. Kent resumed the stand on February 25, and when questioned as to the records of Diamond compounds in his possession after he left the employ of the company, he stated that he felt that such information was no longer confidential after he left the company and that it was his privilege to use such facts in his other connections.

Succeeding Mr. Kent on the stand was HOLLAND B. SLUSSER, vice-president and treasurer of Pocono Rubber Cloth Co., Trenton, N. J. Mr. Slusser was employed as a chemist by Diamond from July, 1910, to June, 1913, and later with Knight Tire & Rubber Co., from 1913 to 1917, after which he went with Hodgman Rubber Co. Mr. Slusser testified as to use of dimethyl-para-phenylenediamine, aniline and thiocarbanilide during the period of his employment at Diamond and produced personal records to show the experimental use of these materials in compounds in the laboratory. He also stated that he introduced the use of thiocarbanalide at the Knight plant in 1917.

At this point counsel for National Aniline introduced into evidence a large number of exhibits including patents, photostats of advertisements, articles and portions of technical books, etc., mention of which was given earlier in this report.

WILLIS F. AVERY, of the patent division of the Legal Dept. of B. F. Goodrich Co., then testified as to the 1912 Diamond sales records and a laboratory notebook from Goodrich records, both of which were entered as exhibits by defendant.

Edgar R. Wagner on Stand

EDGAR R. WAGNER, instructor in chemistry at New York University next took the stand. He was questioned as to the tests made with various accelerators and was then asked whether the following method submitted by plaintiff was a recognized test for dissociation constants:

"DPG was dissolved in boiling xylene (135-136°C) and reflux for 1½ to 2 hours while passing in hydrogen chlorid gas which was generated by adding concentrated sulphuric acid to a mixture of concentrated hydrochloric acid and sodium chlorid. The resulting hydrochloride of DPG was filtered off, washed with petroleum ether, dried over concentrated sulphuric acid for several hours and was analyzed for chlorine by the gravimetric method."

The witness replied that he had never heard of this method

Questioned as to the alkaline reaction of various material Mr. Wagner said that the following showed such a reaction: dimethyl-para-phenylenediamine, paradine, tetramethylene-diamine, quinine, diethyl-aniline, para-phenetidine, trinormal pro-pylamine and butylamine, para-phenyldiamine, beta-naphthylamine. Hexa responded to a large extent while sodium amide and borate of ammonia were not soluble in hot xylene. Thiocarbanilide in itself does not give an alkaline reaction because as a result of the hydrogen chloride it undergoes a decomposition and the decomposition product itself gives an alkaline reaction. As for the condensation product of ammonia and acetaldehyde the witness stated that the test could not be carried out.

On crossexamination the witness stated that there was no particular reaction between silver-perchloride and hydrochloride acid gas but that it came under the head of double decomposition reactions and that the reaction between ammonia and hydrochloric acid gas came under simple addition reactions. The action of ethylamine and HCl gas would be a simple addition or combination. To test whether a salt in solution had a basic or acid reaction Dr. Wagner said under ordinary conditions, the test would be made with litmus.

The succeeding witness was HERBERT N. MCCOY, professor of chemistry at University of Chicago, later technical director and president of a manufacturing firm and now vice-president of another company. Mr. McCoy stated that the leading methods of making tests for dissociation constants were the following: electrical, direct conductivity, Arhenius-Lundeen, solubility, partition, calorimetric and hydrogen-electrode. The witness had tested dimethyl-paraphenylenediamine and found the constant to be greater than 1×10^{-8} by the electrical conductivity method and by a combination of calorimetric and partition methods. He also tested para-phenylenediamine for which he submitted figures for constants for this material and a number of others. The witness stated that DPG is not an ammonium compound.

At this point this witness was replaced by Mr. Tyler but upon being recalled the next day he was questioned on constants of a number of materials and on various constants tests made for Goodrich in 1923.

The last witness of the day was CHAPLIN TYLER, asst. editor of *Chemical and Metallurgical Engineering* who had made tests in the M.I.T. laboratory for dissociation constants and found TPG to have a constant less than 1×10^{-8} by the electrometric method, but not checked by any other method.

Testimony of February 26

Mr. Tyler resumed the stand and submitted a copy of a report on constants made for Goodyear Tire and Rubber Co. in 1923 on DPG, TPG and other accelerators.

MORRIS F. HALL, Instructor of Chemistry at Harvard University was then called. Mr. Hall had made tests of dissociation constants of TPG by the direct conductivity method and found, as had the previous witness, that the constant was less than 1×10^{-8} while dimethyl-paraphenylenediamine was greater than this figure. He described tests made by the Lunden conductivity method and produced laboratory records and notes of these experiments.

CLAYTON W. BEDFORD, well-known rubber research chemist of the Goodrich Co., then took the stand. He stated that he had been with the Goodyear for about ten years and with Goodrich for the last 4 years.

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Mr. Bedford recounted the use of accelerators at Goodyear beginning in 1912 with aniline, thiocarbanilide and beta-naphthylamine. The use of aniline was gradually discontinued while thiocarbanalide and later hexa were used extensively. Then a large number of accelerators were introduced among which were aldehyde-ammonia, TPG and DPG. He attributed increased tire mileage to the five following reasons: (1.) Use of air bags in curing; (2.) Change from fabrics to cords; (3.) Use of carbon black in treads; (4.) Introduction of straight-sides; (5.) Use of organic nitrogenous accelerators.

As for the materials mentioned in the patent in suit, hexa was the only one which had contributed anything to the industry. In 1923-1924 Mr. Bedford made a series of tests on organic accelerators in the Goodrich laboratories and presented two charts showing the results obtained in the form of dissociation constants and various curves. The first group of these tests were made with one part of accelerator (except ammonia, of which only ¼ of the amount was used), 100 parts of pale crepe and 10 parts of sulphur cured at 275° F. The other tests used the same amount of accelerator and rubber but only 4 parts of sulphur and 10 parts of ZnO added. This was cured at 287° F.

The results plotted on the charts for the first series showed that the compound containing piperidine gave maximum physical properties in 55 minutes whereas the control required 360 minutes. With tribenzylamine the time was 350 minutes and with thiocarbanilide the time was approximately the same. In the graph the constant of each material was shown so as to attempt to determine if the accelerating properties of each material tested increased with an increase in constant. Tri-normal-propilimine with a constant of 48000 times 10^{-8} gave curing time of 245 min. while urea with a constant of 1.5×10^{-14} (which is less than 1×10^{-8}) showed maximum tensile in 180 min. As a result, Mr. Bedford concluded that there was no relation of dissociation constants to accelerating power and that 1×10^{-8} is not a dividing line between good and poor accelerators.

Bedford Resumes on March 1

C. W. Bedford continued on the stand on Monday, March 1. He stated that the five advantages obtained from the use of nitrogenous accelerators were acceleration, vulcanization at lower temperatures, use of lower percentages of sulphur, higher physical properties of finished product and improved aging. Placing the nitrogenous accelerators in the order of their activity Mr. Bedford headed the list with piperidine followed closely by DPG and benzylamine and then dimethyl-para-phenylenediamine. When ZnO was used in the compound and sulphur reduced to 4 parts he found that DPG and piperidine were very close with the former slightly in the lead, with benzylamine, dimethyl-para-diamine and para-phenyldiamine following in the order given.

Thiocarbanalid on the other hand was found to be a poor accelerator unless large amounts of zinc oxide were added. In telling of how accelerators act, the witness stated that it was not known definitely but that Prof. Bruni considers that nitrogenous bases function by the reaction of sulphur to form nitrogen disulphides.

Mr. Bedford then described tests conducted along the lines of British Patent 787 of Thomas Rowley in 1881 in which samples of rubber were vulcanized in an autoclave in the bottom of which was placed a solution of ammonium gas in water. These samples containing varying amounts of sulphur were heated for 50 minutes and were all well cured according to the witness. When the ammonium solution was omitted and plain water substituted the samples were undercured after being heated for approximately the same length of time.

Additional patents on this process were later issued to Geoffrey and Dolore in France in June 1903 (No. 329,519), and to A. O. Bourn, U. S. Pat. 697,792, April 15, 1902. Mr. Bedford then stated that Ostwald in Pat. 10,361 (1910) used nitrogenous organic accelerators for the improvement in natural aging of the vulcanized product and similarly in the Hoffmann & Delbruck U. S. Patent No. 1,081,613 of Dec. 1913 there was described the same advantage as applied to synthetic rubber. German patent No. 265,221 (Oct. 1913) also was clear according to Mr. Bedford in setting forth that nitrogenous accelerators shortened the time of vulcanization and made possible the use of lower vulcanizing temperatures. Belgian patent No. 261,870 also treats of acceleration of synthetic rubber by the use of nitrogenous bases. Following this, the witness made a comparison of the patent in suit and a translation of German patent of Bayer Co. filed in 1913 which were stated to be corresponding patents.

On cross-examination by plaintiff's counsel, Mr. Bedford was questioned as to use of hexa, aldehyde ammonia, TPG and DPG by Goodrich and he stated that they were all being used in considerable quantities with the exception of TPG. After a short questioning on methods of preparing graphs as usually practised in the rubber industry the cross examination was suspended while Charles R. Boggs was recalled to the stand.

Hoffman-Gottlob Patent Suit

(Continued)

Boggs Recalled

Mr. Boggs produced a diary showing receipt of beta-naphtylamine in June 1913 and also original reports of insulating department of Simplex Wire & Cable Co. for June, 1913 with a number of compound cards of same date showing use of the above material.

Following this testimony Mr. Bedford resumed the stand. He was questioned as to method used in plotting the graphs of the tests of 1923-4 at Goodrich and the Bruni article on nitrogenous bases.

At this point various patents, rubber price records, etc. were entered as exhibits. Letters relating to the patent in suit between Grasselli and National Aniline were also entered as exhibits.

Rebuttal Proofs

The first rebuttal witness called by plaintiff was JAMES KENDALL, Professor of Chemistry at Columbia University. Mr. Kendall disagreed with the results of dissociation constants of TPG as given by Dr. N. F. Hall of Harvard saying that the methods used were fundamentally wrong inasmuch as the solubility method is applicable only to salts which are extensively hydrolyzed in aqueous solution and TPG is not hydrolyzed in aqueous solution.

By the use however of the direct conductivity method Prof. Kendall verified Dr. Hall's dissociation constant of 8.38×10^{-8} for TPG as being correct. This value is greater than 1×10^{-8}. In regard to Mr. Tyler's testimony on the use of the electro-metric method, the witness stated that this method was not suitable for the determination of the dissociation constant of acids or bases and therefore not suitable for TPG.

Dr. Kendall then told of the simplicity of dissociation tests and the use of them made in various industries. The witness found the dissociation constant of dimethyl-para-phenylenediamine to be 3×10^{-8}, a figure in agreement with that found by Dr. McCoy.

On cross examination the witness told of the large number of acids and bases whose constants were known and could be found in published literature such as Scudder's textbook. As to TPG and DPG he stated that he knew of no published values for the constants of these materials by the direct conductivity method.

Testimony of March 2

Prof. Kendall resumed the stand the next day and explained his use of the Walker-Brady method instead of the direct conductivity method for determining the constant of dimethylaniline as due to the saturated solution of this material being so little greater than that of the water available as to make the results unreliable. The method used in this case was directly applicable to bases with constants about 1×10^{-10} or 1×10^{-9}. The witness was then questioned as to the methods which in his opinion were applicable to various materials.

On redirect examination the witness testified as to methods to use to determine constants greater than 1×10^{-3} such as the calormetric and the direct conductivity methods. Upon recross examination he stated that constant determinations by osmotic pressure, freezing point, elevation of boiling point methods were unreliable.

The next rebuttal witness was DR. CHAS. A. KRAUS. He stated that despite the constants for TPG determined by Messrs. Hall and Tyler, his figure of 8×10^{-8} was correct and that the method he used was proper for that material. As for experiments on conductivity measurements conducted prior to 1913 at dilutions greater than 1000 litres Dr. Kraus said he knew of many instances and pointed to them in Landolt and Bornstein's *Tabellen*.

On cross examination the witness stated that one of the dissociation tests he made on sodium amide was in liquid ammonia solution but that the other substances were tested in water on account of their solubility in water. It would be possible with certain substances in water to get a value greater than 1×10^{-3} and in alcohol or acetone or some other solvent a value a great deal less than that figure. As a result of the introduction of tests with a solution in liquid ammonia instead of water the defendant stated that the patent in suit did not define "dissociation constant" and that the witness had testified that the same substance in liquid ammonia may have a constant within the patent whereas in water it would be outside the patent. The witness stated that unless otherwise specified water would be intended as a solvent.

WALDO B. BURNETT, research chemist at Mellon Institute of Industrial Research was the next witness in rebuttal called by plaintiff. Witness determined certain dissociation constants by the direct conductivity method.

JOHN B. TUTTLE was recalled in rebuttal. He stated that hexa had been used in the rubber industry since 1915 or 1916 and is still used extensively. DPG was first used in 1920 and is used in practically all types of compounds. Aldehyde ammonia is used but not to such a great extent and TPG was first used in 1916 and is still used slightly. These four modern accelerators have had a revolutionary effect on rubber compounding resulting in great economies and in greater tire mileage. Organic accelerators have in addition caused great changes in manufacturing operations. Prices of DPG, aldehyde ammonia and hexa were then given for 1923 to 1925 showing a gradual reduction in prices on DPG from $1.29 to $1.06; hexa from .95 to .84 and an increase on aldehyde ammonia from .25 to .94. Crude rubber consumption figures were also given for the same years as taken from official records.

Testimony of March 3

On Mr. Tuttle's return for cross-examination on March 3, he told of his lack of knowledge of dissociation constants in 1915 but he knew where to find them or whom to consult. As to the efficiency of modern accelerators compared with thiocarbanilide the witness was unable to state. In the period from 1910 to 1915 the exact determination of the presence of aniline or thiocarbanilide in manufactured products was not possible unless some indication were given as to what was being sought stated Mr. Tuttle.

DR. STEVENSON who had previously testified was recalled and stated that a basic reaction is an alkaline reaction, that is one charcteristic of basic substances on tests which witness made with TPG, DPG and other substances they all showed alkaline reactions as demonstrated by alkaline indicator over a range of degrees. TPG and DPG are anyhydrous forms of ammonium compounds said Dr. Stevenson.

At this point apparatus was produced in court to make simple dissociation tests on DPG and di-ethylaniline solutions as follows: Into test tubes, samples of both of these materials were poured and then into each were placed three drops of methyl red upon which the DPG solution turned pinkish while the other substance did not change in color. Thereupon the witness stated that this test proved that DPG had a dissociation constant greater than 1×10^{-8}.

CARL S. WILLIAMS of the R. & H. Co. was then recalled and testified as to shipments of various accelerators which had been made by his company to Goodrich. He particularly recalled lots of hexa of 5000 to 10000 lbs., in 1917 and continuing up to the present. He also stated that R. & H. had been paying royalties to Grasselli on this material on the patent in suit.

Testimony of Ira Williams

The next witness was IRA WILLIAMS, chemist at the Mellon Institute. Mr. Williams had been employed at the Firestone plant from 1920 to 1923 and at the Institute since that time. Witness submitted a chart containing information on tests made on various accelerators with the dissociation constants of each, their chemical formulæ, an actual bottled sample of each accelerator, samples of cured rubber and the speed of acceleration of the compound based on similar compounds in which the accelerator had been omitted. Using *one* as the speed of such a compound Mr. Williams determined the speed of the compounds containing the various accelerators and reported them as follows:

sodium amide	1.45
ammonia borate	1.37
para-phenylediamine	3.35
2-5 tolulenediamine	2.79
1-4 naphthylediamine	1.82
tetramethyl-ammonium hydroxide	5.85
benzylamine	4.75
acetaldhyde ammonia	4.22
hexa	3.10
hydrobenzamine	2.30
DPG	4.6
TPG	1 34

Several other charts submitted showed the rate of speed obtained from combined sulphur tests, elongation test graph, tensile curves, etc. After a short cross-examination on the data contained in these exhibits, attorneys for both sides went to the New York office of Goodrich to inspect some records which the company did not desire to be open for public inspection.

Hoffman-Gottlob Patent Suit
(Concluded)

Testimony on March 4

Ira Williams was recalled and upon further examination he stated that 15 or 16 of the total number of substances tested had dissociation constants less than 1 x 10^{-5}. As to use of ZnO in compounds the witness testified that by its use the speed of acceleration was increased. Referring to the charts Mr. Williams admitted that if the tensile results had been plotted after 120 minutes instead of 60 minutes (the time used in the tests) many would have been overcured and therefore would have given lower tensiles.

The testimony of the next witness, called by plaintiff in rebuttal, was DR. W. G. GROSVENOR, consulting chemist and factory engineer. Dr. Grosvenor stated that his first interest in rubber accelerators was in 1922 when he was approached by the Heyden Chemical Co., in reference to the patent in suit but the witness stated that after reading the patent he advised the company to take out a license rather than contest the patent.

The first matter discussed by Dr. Grosvenor was Rowley Brit. Pat. No. 787 (1881) which was stated to be for the use of ammonia gas for vulcanizing or desulphurizing and not for accelerating purposes for no temperatures or time periods for vulcanization were disclosed. In reference to Bourn U. S. Pat. 697,792 he stated that this also was a process for vulcanizing rubber by the use of ammonia because this substance had an affinity for sulphur and to neutralize the deleterious action of excess sulphur in rubber which might cause overcure and poor aging. No hint of acceleration was disclosed in this patent.

Turning next to French patent No. 329,519 (Feb. 18, 1903) the witness stated that this consisted of vulcanizing in a small autoclave into which NH_3 gas was introduced under pressure or produced with ammonium salt and a base. Heat was then applied to 140° C for 40 to 50 minutes. By this system the time of raising temperature was shortened and the absence of air and substitution of NH_3 under pressure would prevent any injury likely to be caused by the increased temperature and pressure.

Ostwald's Brit. Pat. No. 10,361 was typical of a group of similar patents, stated the witness which certain materials were used as de-celerators (anti catylists) instead of accelerators. Other patents including those of Bayer Company were discussed showing uses to which various substances were put. For the purposes of the record the witness' comments on these patents were all summarized and entered on the records. This information was not disclosed.

Several charts were put into evidence showing the structural formulæ of various methylene bases and other substances. Under questioning the witness then stated that hexa was not a methylene base.

After recess, OSCAR CARLBERG, a patent attorney, was put on the stand by plaintiff and testified that Belgian patents are usually kept secret for a period of three months after filing.

The next witness was JAMES F. BROCHASKA, Grasselli salesman. In his previous duties in the auditing department of the Grasselli Co. the witness testified that he had received instructions that all shipments of accelerators or other compounding materials to Diamond and Goodrich should be marked "Pigment No. —" and that the exact name of the material was not to be shown. The witness recalled that among the materials so labeled were heavy chemicals, Grasselli White (lithopone) and acids.

Following these two witnesses Dr. Grosvenor continued his testimony by comparing the copies of German and U. S. patents of Hoffmann and Gottlob. He stated that the U. S. patent outlined restrictions clearly while the German application gave several alternatives. The U. S. patent includes both materials having dissociation constant greater than 1 x 10^{-5} and having a basic reaction at vulcanization temperature while the German patent says that either one or the other only is necessary.

The witness repeated that neither TPG nor DPG are methyl bases and that they fall into the class of materials mentioned in the patent in suit for the following reasons:

1. Both have dissociation constants greater than 1 x 10^{-5}.
2. Both are ammonium compounds.
3. Both have basic reactions at vulcanizing temperatures.
4. Both accelerate vulcanization.
5. Both chemically and physically fall into the class of compounds mentioned in patent in suit.

Following this statement, Dr. Grosvenor said that the curves submitted by Mr. Bedford did not show the accelerating power of various substances and he (the witness) did not agree with Mr. Bedford as to high accelerating power of piperidine. As to availability and cost of sodium amid and quaternary bases the witness stated that they are available in reasonbly large amounts and at fairly low prices. Dr. Grosvenor also stated that in his opinion the disclosures in the patent in suit were applicable to both high and low grade rubbers and to synthetic rubber.

After a very technical discussion of the structural formulæ of a number of substances, testimony was concluded for the day.

Testimony of March 5

Dr. Grosvenor was recalled on the last day for cross examination and gave the structural formulæ of various substances including methylene blue. As to para-amio-dimethyl-aniline the witness stated that this substance has been known for years. Questioned as to the time, as previously testified, when Dr. Grosvenor had been asked to consider the patent in suit by the Heyden Chemical Co., he stated that hexa was one of the substances under consideration. As for the experience of the witness on rubber accelerators he said that it had been obtained mainly in the past few years and that it consisted of personal tests of various accelerators, visits to rubber factories and an investigation of published literatures on the subject.

In reference to the statement on compounds and methylene bases which had been prepared by the witness and entered on the records, he was questioned as to the proportion of the organic accelerators and basic nitrogenous compounds mentioned in that statement which were known as ammonium compounds and he answered that 90 or 95% fell into that classification. Only a few hundred of them however have been tested for dissociation constants and the rest might be determined by indicators. As to aldehyde-ammonia the witness stated that this substance was not an open chain base accelerator.

In commenting on Bedford's testimony of the Rowley patent, Dr. Grosvenor stated that the conditions under which similar tests had been conducted by Rowley and Bedford differed in that Bedford utilized a mixture of sulphur and rubber while Rowley had used sulphur, rubber and litharge or ZnO or substances of that character and that Rowley also expected to be able to make use of some of the sulphur in the ammonium compound. In reference to temperature, the witness said that Rowley had not made a definite disclosure and that therefore Bedford had not been able to reproduce the Rowley tests. The temperatures used by Goodyear eighty years ago, Rowley and Bedford were however all about the same the witness admitted.

At this point a number of exhibits were entered into the records including several publications which had been mentioned by Dr. Spence in his testimony, laboratory record's of Mr. Boggs, Pearson's book on Compounding Materials (1918 edition), etc.

Dr. McCoy Recalled

Dr. McCoy was then recalled and was questioned at length on methylene and methyl groups and he also refuted the testimony of open carbon chains of the previous witness. His definition of a methylene base was given as one which is saturated as distinguished from an unsaturated base such as aniline. He next testified that he thought that Dr. Burnett of the Mellon Institute had not obtained the proper constant for aldehyde ammonia for this substance decomposes very rapidly under the conditions of the test as shown by the results and by the graphs which disclosed its rapid increase in electrical conductivity. As to the zero time shown in the graphs, Dr. McCoy stated that there was no indication shown as to the reason for the direction of the curve which was arbitrarily exterpolated, and that if its direction were changed a much lower conductivity would have been found.

The next witness was C. W. Bedford who was called to testify as to certain portions of Ira Williams' testimony. Mr. Bedford differed with Mr. Williams on the definition of acceleration and stated that acceleration is a time factor relating to the vulcanization of rubber for commercial purposes and that it was not related to the coefficient of vulcanization. Refering to the speed chart of Mr. Williams the witness pointed out that aniline had given a speed factor of 1.85 whereas TPG had a speed factor of 1.25 thus proving that aniline is a better accelerator than TPG. As to certain test record cards of Mr. Williams which were in evidence the plaintiff stated that they had been put in by mistake and that no information from these cards had been entered on the graphs.

Mr. Bedford then cut narrow strips from the samples of cure stock which were included in Mr. Williams' chart and showed that the samples made up with ammonium borate and TPG had a low tensile for they broke easily when pulled by the witness whereas the sample made up with para-phenylene-diamine did not break so easily. This test proved, according to the witness, that the two samples which broke easily were not vulcanized in accordance with the disclosures in the patent in suit in that they were not completely vulcanized. As to the use of thiocarbanilide as an accelerator in the manufacture of tires Mr. Bedford stated that tires so made would be satisfactory and that they would give good mileage. This was contrary to the statements made by J. B. Tuttle on the advantages of thiocarbanilide.

Dr. McCoy was recalled and questioned as to the time effect in determination of constants of substances which decompose in water and the witness referred to Ostowald's test for constants at six different concentrations, of materials which decompose rapidly. There followed a long questioning on methylene bases and the structural formulæ of such bases and on the matter of a definition of a methylene base the witness stated that he did not recall a definition for such substances in any text books which he had consulted.

Mr. Bedford was again put on the stand and admitted that in his book, *Systematic Survey of Rubber Chemistry*, there were included references to sulphur coefficients. As to tests for the determination of combined sulphur Mr. Bedford stated that such tests were made and were of value to rubber chemists. There followed a comparison between a chart submitted by Mr. Bedford earlier in the day, in which he had plotted certain of the tests made by Ira Williams, and the original chart of Mr. Williams.

Final Witness

Dr. Grosvenor then testified that methyene bases have the same characteristic group as the bases mentioned in the patent in suit. Testimony was concluded with the witness.

It was then agreed between the attorneys that briefs be submitted to each other within three weeks for mutual answer and that arrangements would be made later for the arguments before the court on the briefs. After such arguments are completed the case will be in the hands of the judge for decision and at this time it is not known when such decision may be expected.

Re: *Abstract of Testimony in Grasselli* vs. *National Aniline Suit*

In reporting the testimony of every witness in the Grasselli-National Aniline suit on the Hoffmann-Gottlob patent, it has been the aim of THE RUBBER AGE to refrain from drawing any conclusions whatsoever from the statements made on the stand by the witnesses.

Inasmuch as the testimony was concluded late on Friday afternoon, March 5, the reader can appreciate the necessity of haste in preparing copy in order that complete details might be available in this issue, and it is hoped that the strict neutrality which we have attempted to observe in all respects will be obvious, so that our aim to give an unbiased account of the trial may be realized.

CURTAILED CONSUMPTION REDUCED CRUDE PRICES

The campaign of conservation of American rubber manufacturers has been responsible for the decline in prices of crude rubber rather than any change in the statistical position so far as shippers are concerned, according to F. R. Henderson, president of both Henderson, Helm & Hammesfahr, and of the Rubber Exchange of New York. In a review of conditions February 23 Mr. Henderson said:

"The market during the past week reflects a situation in the rubber industry that seems worthy of considerable attention. There has been practically no change in the statistical position insofar as shippers are concerned. Actual rubber received during December, January, and so far this month, is just about the amount expected, and as near as we are able to ascertain, shipments from the Far East during the next few months will not be appreciably in excess of what has been generally estimated.

"The course of the market has been consistently downward since the beginning of the year, and this can be attributed almost entirely to the situation in this country. Excessive speculation on the "bull" side in London carried the market to over $1 a pound for spring delivery, and it was then that the American manufacturers launched their campaign of conservation. This has been accomplished in two ways: First, by larger use of reclaimed rubber; second, by abolishing of shipping tires in winter months for payment in the spring.

"These factors materially reduced the actual consumption of crude rubber during the past three months. The consequent surplus of arrivals has brought the stock on hand to a more satisfactory position, but these elements working together have had a more depressing effect than was anticipated. In addition sudden liquidation of "long" accounts in London accentuated the decline.

"With April, May and June positions selling at about 54c today, and July at 53c, serious consideration should be given to accumulating rubber for spring delivery. We believe that the market for the next few months will offer many opportunities for profitable trading."

Wild Exports Growing

Wild rubber collection in the Amazon Valley has been so stimulated by high prices that total rubber shipments from the wild rubber region during the calendar year 1925 are expected to be reported at not less than 26,000 metric tons, according to a report issued by the Department of Commerce.

According to consular advices received at the Department of Commerce, prosperity has again been brought to the Brazilian port of Para and the Amazon Valley after nearly ten years of depression. The extent and effects of this revival are impossible to calculate, the messages indicated, but signs of the new prosperity are to be seen on every hand in Para, while the life of the rubber gatherer in the remotest part of the Amazonian forests has been effected as well. The situation is such, the reports declared, that the Amazon Valley is the only part of Brazil that is considered prosperous.

If the 1925 calendar year figure is placed at 26,000 metric tons, it will represent an increase of 2,000 metric tons over the total production of the crop year 1924-25. It has also been estimated that collection of wild rubber for the 1925-1926 crop year will represent an increase of 25 per cent over the preceding twelve month period, although recent reports have indicated that the increase may be even greater.

Officials express the belief that increased collection of wild rubber had been a factor in reducing the price of plantation rubber.

HAS RUBBER TREE IN FRONT YARD

Thomas W. Ward, aged 91, suggests that rubber executives, who are skeptical about the feasibility of growing rubber in California, should visit his front yard in Carpenteria. Mr. Ward says that a rubber tree 70 feet high, with foliage so dense that it is almost impenetrable, has been growing in this yard for years. Mr. Ward and his daughter have made a study of ornamental and useful trees and have many species growing near their home in Carpenteria.

Elect New Members

F. R. Henderson, president of the Rubber Exchange of New York, recently announced the election of the following member firms to the Rubber Exchange Clearing House, which operates in conjunction with the exchange.

The Avia Co., Inc.; J. S. Bache & Co.; T. A. Desmond & Co.; Diamond Rubber Brokerage Co.; L. W. Dumont & Co., Inc.; Earle Bro. Corp.; Paul Elbogen & Co., Inc.; J. P. Grant; Harriss, Irby & Vose; Henderson, Helm & Hammesfahr; H. Hentz & Co.; Edward Maurer; Geo. H. McFaddes & Bro.; Munds & Windslow; Post & Flagg; Pynchon & Co.; M. Rothchild & Co., Inc.; Chas. T. Wilson & Co., Inc.; and Chas. E. Wood, Inc.

The total volume of trading on the Rubber Exchange of New York during the first week, which ended February 20, was 3,724,000 pounds, or 532 long tons, according to an announcement by Secretary Walter Dutton. The volume of trading by days follows: February 15, 128 contracts; February 16, 116; February 17, 60; February 18, 94; February 19, 119; February 20, 15. Each contract calls for 2½ long tons.

Goodyear Awards Pins

Lucien L. King, advertising manager and R. W. Snyder, manager of the machine design department of the Goodyear Tire & Rubber Co., Akron, were awarded 15-year service pins in February.

HEAT-PROOF TUBE IS ANNOUNCED BY INDIA

Discovery of a heat-resisting formula to prevent continued vulcanization of tires and tubes after they are in service has been made in the laboratories of the India Tire & Rubber Co., Akron, and recently announced to the trade.

Tire chemists have worked for years to develop something to combat the tendency of tires and tubes (tubes particularly) to keep on vulcanizing under the high-heat conditions developed within the casing when traveling at high speeds.

The new India True-Blue heat-proof inner tube has already given some very remarkable demonstrations of its ability to stand up under unusual service conditions.

It was not only necessary to develop a treatment of rubber to make the walls of the tube withstand the terrific sustained heat which occurs inside the casing but also to improve the splice, where the ends of the tube are joined. This has always been the weakest spot, being already double-cured during manufacture. So a new method of splicing also had to be found and the India chemists and engineers seem to have accomplished the desired result after many months of test and experiments by bringing out the Sure-Vule splice, as it is called. It is said to resist heat and age to a most remarkable degree.

While the development of this heat-proof tube is of great importance to all car owners, it is of particular significance to bus and truck operators, India officials say. Buses run steadily for long distances at high speeds. Tires get so hot in the summer under these conditions that in some cases they have to be cooled off with a hose at bus stops. This is especially true on the long distance bus routes over the sun-swept roads of California. This new tube has been tested and proved under these very conditions, said to be as severe as can be found in any kind of service.

Branch Holds Meeting

Representatives of the Firestone Tire & Rubber Co., Akron, in North and South Carolina attended a recent meeting of the Charlotte, N. C., branch in the Charlotte Hotel. L. L. Heidacher, branch manager, spoke on the general condition of the rubber industry and the condition of the Firestone branches in the two Carolinas.

To Manufacture Batteries

The Danville Battery & Rubber Co., Danville, Ill., was recently organized, with a capital stock of $100,000, to take over the old Witer Battery Co., which has been inactive for some time. Incorporators are C. J. Young, J. F. Geddes, W. A. Glenn, John Thornburn and John Wunker. The Witer factory will be operated for the time being, but the plans of the company, which include the manufacture of tires, will make it necessary for larger quarters in the future.

Midland Reorganized

R. T. Shelton, formerly president of the Midland Rubber Co., St. Louis, Mo., has relinquished control of that company and plans to retire from active business. A new corporation, called the Midland Rubber Goods Co., with an authorized capital of $40,000, was recently chartered to take over the other company. Officers are J. F. Burmeister, president; and H. H. Godejohann, secretary and treasurer. In addition to these officers, the board of directors is composed of W. A. Vossa, J. R. Verdier and O. Hagist. The new company will operate the Midland factory at Masceutah, Ill., which has a capacity of 75,000 garments a year. The Midland company has been manufacturing raincoats and aprons.

Barber Gets Alloy Rights

Announcement was recently made by the Barber Asphalt Co., Philadelphia, that exclusive rights to manufacture "Aterite", a non-corrosive, acid-resisting metallic alloy had been acquired from the Aterite Co., Inc., New York. The Barber company is now in a position to furnish "Aterite" valves, fittings and special castings. These will be manufactured at the Iroquois plant of the company in Buffalo, N. Y. "Aterite" is recommended for use with acids, organic compounds, salts, bases and colors.

INFORMATION EXCHANGE

The inquiries listed below have already been answered but additional information from our readers will be welcome. Mention the reference number in correspondence. Address:

Information Exchange

THE RUBBER AGE, 225 Fourth Ave., N. Y.

Soft Rubber Rolls

(Reference No. 174) Can you supply the names of manufacturers of soft rubber rolls for use in duplicating machines? We want a roll with a steel or brass center.

* * *

"Fat Men's Suits"

(Reference No. 175) Would you kindly supply us with the address of a company which would manufacture rubber (inflated) "fat men's suits"? The firm which formerly supplied us with this kind of equipment has discontinued business.

* * *

Equipment

(Reference No. 176) We are interested in the installation of equipment for the production of sponges, catheters and rubber thread. Kindly give us the names of some manufacturers who could furnish the necessary equipment. We desire to know the number of machines required for a production of 200 sponges, 140 catheters and 250 lbs. of rubber thread in an eight-hour day; the type best suited for the purpose; the number of hands required and the amount of steam and water consumed.

Rubber Industry Should Have Large Exhibit at 1926 Sesquicentennial

THE RUBBER AGE learns that the Board of Directors of the Rubber Association of America has under consideration the advisability of a rubber exhibit at the Sesquicentennial International Exposition to be held in Philadelphia from June 1 to December 1, 1926. It had been thought by the Rubber Association directors of last year that the plans of the exposition management had not progressed to an extent which gave real indication of its scope and undoubted success, and the directors were awaiting new developments before giving further consideration to active participation.

There is no doubt that the sponsors of the exposition had originally announced extravagant plans impossible of fulfillment, but at the present time there is every indication that this condition no longer exists and that the new plans recently announced are more within reason and practically certain of success. When Mayor Kendrick of Philadelphia assumed personal direction of the exposition, late in October he immediately revised the scope of the plans in line with the dictates of common sense.

A statement made by exposition executives the other day, throws further light on the subject which is of timely interest. It said in part, "On Jan. 20, the national advisory commission to the Sesquicentennial Exposition, appointed from each state by President Coolidge, met in Philadelphia and quashed the postponement talk emanating from outside Philadelphia by unanimously endorsing Mayor Kendrick's purpose to open on June 1, this year. The Senate and the House of Representatives at Washington have since passed an appropriation of $2,186,500 on the understanding it will be held this year and not in 1927."

Such action should, of course, dispel any doubt of the success of the exposition which the industry might harbor, and it is to be hoped that steps will soon be taken by the new Board of Directors to insure participation by the rubber industry.

As to the advantages of such an exhibit, there are always a few individuals and companies who believe that expositions are valueless—a feeling which possibly is justified by the results of most expositions. In this case, however, the patriotic and international features of the 1926 Sesquicentennial Exposition promise to surpass anything yet attempted, exceeding in importance the Centennial Exhibition in 1876, the World's Fair in 1893, the Paris Exposition in 1900, the St. Louis Exposition in 1904 and the Panama-Pacific International Exposition in 1915.

As the rubber industry of the United States boasts an annual volume of close to $1,500,000,000, it cannot afford to be among the missing when the Sesquicentennial Exposition opens. Therefore, in view of the more hopeful plans which have been announced by Mayor Kendrick, THE RUBBER AGE urges the Rubber Association directors to give immediate consideration to this exposition in order that the industry may have sufficient time to prepare an exhibit commensurate with the size and importance of the American rubber industry.

Papers Read at Chemists' Meeting

Abstracts of Papers Discussed at Joint Meeting of Rubber Division and Akron Section of A.C.S.

THE JOINT meeting of the Division of Rubber Chemistry and the Akron Section of the American Chemical Society, held at the Firestone Clubhouse in Akron, February 22 and 23, was not only one of the best-attended but one of the most interesting ever held by the rubber division. Abstracts of the 17 papers read at the meeting are published below:

INTERNAL MIXERS FOR RUBBER STOCKS

P. S. Shoaff
Goodyear Tire & Rubber Co.

The use of internal mixers instead of roll mills has become of increasing importance in rubber goods manufacture where formerly practically the only application was for mechanical goods stocks. This type of mixer is now widely used for mixing tire stocks and all grades of master batches as well as for "breaking down" crude rubber in cases where large amounts of rubber compounds are possessed. A certain heavy duty type is successfully used for warming cold mixed stocks preparatory to calendering or tubing, and in a few instances mixers are employed to mass reclaimed rubber.

Recent mechanical improvements and more efficient cooling facilities have advanced internal mixers in favor. Description of the most successful types of mixers are given.

Methods of mixing typical rubber stocks are discussed, and dates of mixing and various data are given based upon the writer's experience with one of the best known makes of internal mixers.

It is usually advantageous to add to a mix previously broken down rubber. The material from these mixers must be sheeted on a roll mill and in the case of sensitive stocks the sulfur must be added and incorporated on roll mills.

The quality of stocks mixed in an internal mixer is uniform and is just as good as that from roll mills; but there is a tendency for the former to be tougher and premature vulcanization of sensitive stocks must be guarded against. These conditions are due to the fact that the internal mixer has less cooling area in proportion to the material handled. These difficulties are not usually troublesome when low temperature cooling water is available. The introduction of water or rubber latex direct to the batch at a certain time during the mixing cycle is a successful practice.

The large savings to be effected and numerous other advantages to be gained as compared with the use of roll mills are such as to make advisable the adoption of internal mixers wherever practicable.

THE GUANIDINES AS ACCELERATORS

H. W. Elroy and D. H. Powers
E. I. du Pont de Nemours & Co.

The behavior of substituted guanidines and their efficiency as accelerators has been studied and found to be dependent on the nature of the groups substituted. Guanidines have been prepared at activity varying from completely non-accelerating to accelerators of high activity. A theory to explain this variation in activity within its class is developed.

IS COMMERCIAL SYNTHETIC RUBBER PROBABLE?

L. E. Weber

The synthesis of rubber divides itself into two definite operations:

(1) The preparation of the Hydrocarbon.
(2) The Polymerization of the Hydrocarbon.

The hydrocarbons which have been used successfully are Isoprene and Methyl Isoprene; the latter generally known as Dimethyl-butadiene.

The most successful method of polymerization has been the method of auto-polymerization, which is carried out by allowing the hydrocarbon to remain for approximately 90 days at a temperature of 60° C.

The synthetic rubber which has been produced to date has been found to be valuable in the manufacture of hard rubber goods, but it has not proven acceptable for soft rubber goods, due to inadequate ageing.

The commercial success of synthetic rubber is dependent upon three factors:

(1) Its quality must be equal essentially to that of natural crude rubber.
(2) Methods of producing synthetic rubber must be developed which will give a uniform product; that is, the product must possess a uniform degree of polymerization.
(3) It must be competitive in price with the natural product.

The first condition will undoubtedly be met. It it also probable that the second condition will be met, although it will be the more difficult of the two to overcome. It is in overcoming the third condition that synthetic rubber will have to wage its greatest fight. In the last analysis this will simmer down to a conflict between the agricultural chemists and the botanists, working together, against the chemical synthesists. The agricultural chemists have been notably successful in devising means for increasing the yields of other plant products. If they meet with only a portion of this success in the cultivation of rubber, the chances of victory for the synthesists look slim.

CYCLOPENTADIENE RUBBER

H. A. Bruson
Goodyear Tire & Rubber Co.

The structural relations of butadiene, alpha mothys butadiene, dimethyl butadiene and cyclopentadiene are discussed. Different methods of polymerizing the cyclopentadiene are given and the various products described. Very complete details of the chemical properties and reactions of these synthetic rubbers are given.

FURFURAL DERIVATIVES AS RUBBER ACCELERATORS

John P. Trickey and C. J. Leuck
Miner Laboratories, Chicago

A review is given of results reported in the literature on the use of furfural derivatives as rubber accelerators. Additional work has been done on these compounds, especially hydro furamid and the thio acids. Other types of furfural derivatives are discussed.

A MICROSCOPICAL METHOD FOR THE DEMONSTRATION OF THE DEGREE OF IMPREGNATION OF FABRICS BY RUBBER

E. O. Dieterich
B. F. Goodrich Co.

To facilitate the cutting of sections, the samples of coated fabric are cured to the hard rubber stage by means of calcium or potassium polysulphides. After cutting, the sections are immersed in concentrated sulphuric acid which removes the cotton fibres without appreciably attacking the rubber structure. Examination under the miscroscope affords a means of comparing the extent of impregnation by different processes.

Photomicrographs are shown of sections illustrating different methods of impregnating fabrics with rubber, such as,

1. Frictioning and coating
2. Impregnation by pressure
3. Latex impregnation
4. Impregnation with rubber cement
5. Electrolytic deposition of rubber from latex.

THE EFFECTS OF ACCELERATED AGING UPON THE PHYSICAL PROPERTIES OF HARD RUBBER COMPOUNDS

E. O. Dieterich and Harold Gray
B. F. Goodrich Co.

For soft rubber compounds the stress-strain curve is a satisfactory means of measuring the changes which occur in these compounds under the conditions of accelerated aging such as the Geer test. In the case of hard rubber compounds the same criterion cannot so easily be applied. By choosing different properties, such as transverse strength, impact strength and softening temperature, the effects of accelerated aging can be followed.

Hard rubber compounds were aged at 158° F and 300° F to determine:—

1. The effect of cure
2. The effect of accelerators
3. The value, in hard rubber, of age retarders that have been found satisfactory in soft rubber compounds.
4. The effects of inert and of active pigments.

From the results of these experiments the following conclusions may be made:—

Up to 14 days, aging at 158° F produces relatively small changes in the physical properties of hard rubber compounds.

At 300° F the deterioration is rapid and very great.

Compounds receiving the optimum cure are less effected than under cured compounds.

The effect of accelerators is not very marked.

Age retarders valuable in soft rubber compounds appear to have no beneficial effect in hard rubber compounds, so far as the present investigation goes.

The percentage effect on heavily loaded compounds is less than on pure rubber—sulphur compounds.

The effect of aging is not an overcure, as the percentage of free sulphur remains constant.

HIGH AND LOW STIFFENING CARBON BLACKS

Ellwood B. Spear and Robert L. Moore
R. T. Vanderbilt Co.

Carbon blacks may be divided arbitrarily into two main classes. One class stiffens rubber or oils much more than an equivalent volume of ordinary zinc oxide, whereas a second class stiffens rubber or oils to approximately the same extent or in some cases even less than zinc oxide.

The tensiles at the point of rupture of carbon stocks containing a member of these two classes separately, may be quite as high in one case as in the other. The elongation at break is usually much greater where the low stiffening carbon has been employed.

The amount of oil necessary to wet thoroughly a given quantity of carbon is a reliable qualitative, but not an absolute quantitative measure of the stiffening power of the carbon in a rubber mix. The stiffening power of a carbon in a rubber mix is not necessarily an index of the adsorption by the carbon of Malachite Green in aqueous solution, Victoria Blue in benzol solution or Hexamethylenetetramine in benzol solution.

Observations on carbon black rubber stocks under the microscope indicate that there is a close relationship between distribution of the finest particles of the carbon in the rubber matrix and the tensile at the point of rupture. There appears to be no definite relation between the size of the particles or aggregates of carbon in the rubber mix and the stiffening power of the carbon for rubber.

THE CHEMICAL UNSATURATION OF RUBBER UNDER THE ACTION OF HEAT, TRICHLOROACETIC ACID AND MASTICATION

Harry L. Fisher and A. E. Gray
B. F. Goodrich Co.

A review is given of recent work on shellac and rubber which apparently shows that the chemical reactivity is varied by physical treatment. Hydrogenation of rubber has been brought about only through the previous action of mastication and heat, and by high dilution with solvents. It was thought that some of these physical changes might also be accompanied by chemical changes. Under the action of heat there is a lowering of the chemical unsaturation, the amount depending on the time and temperature, (verification of the work of Staudinger). Trichloroacetic acid not only causes a lowering of the viscosity of a rubber solution, but also of the chemical unsaturation. Mastication in air causes a lowering in the unsaturation possibly due to absorption of oxygen, but in carbon dioxide there is no change in unsaturation, although there is, of course, a decided change in the physical properties.

SOME FACTORS INFLUENCING THE WEATHERING OF VULCANIZED RUBBER

N. A. Shepard, S. Krall, and H. L. Morris
Firestone Tire & Rubber Co.

The fact that vulcanized rubber in a stretched or strained condition is very susceptible to cracking or checking, especially under the influence of direct sunlight, has been utilized in an accelerated test for studying the deterioration of rubber compounds when exposed to the weather. This test has been used in determining the influence of cure, sulfur bloom, color, grade of rubber, reclaimed rubber, several filler pigments, several kinds of softeners, accelerators, and an anti-oxidant on "sun cracking."

THE EFFECT OF HEAT ON RUBBER

James K. Stewart
Firestone Tire & Rubber Co.

Based on the assumption that the breaking down of rubber was connected with the formation of a sol phase at the expense of a gel phase, a method for breaking down rubber was outlined which consisted of heating rubber, with the swelling agent benzene, in a bomb to a temperature of 150° C and a pressure of 84 pounds. Temperature pressure curves indicated that the breaking down of rubber was essentially a physical change.

This drastic action resulted in a marked increase in plasticity of the treated rubber, and in a distinct decrease in viscosity of the cements made from it. Cured samples showed as good a tensile as the control in which moderately milled rubber was used. The former, however, aged very rapidly in the oven. Samples of cements had a tendency to become more viscous after prolonged standing. This might have been due to a partial setting-up action.

VOLUME CHANGES IN RUBBER SOLS

Willis A. Gibbons and Erdley Hazell
United States Rubber Co.

The volume changes associated with the formation of some rubber sols have been measured.

The volume change may be an expansion or contraction, depending upon the previous treatment of the rubber and the nature of the solvent.

Volume changes of different signs may take place in one and the same solvent according to whether or not the rubber is broken down.

In general the volume changes are largest at lower concentrations and at higher temperatures, and are practically independent of time.

THE ADDITION OF LIGHT TO ACCELERATED AGING

F. P. Jecusco
Chatham Mfg. Co., Middletown, Conn.

A mercury vapor ultra-violet lamp (Uviarc) was inserted in a Geer Aging Oven, after the manner proposed by Asano, i.e. at 7 cm. distance from sample and at an oven temperature of 160° F. Judging the destructive effect by the appearance of the samples and from a comparison of physical and chemical data obtained with other aging processes, this heat-light combination reduced the time required for destruction from a matter of days to that of hours.

This work was confined solely to vulcanized rubber sulfur mixes, as these compounds have given some trouble both in the Geer Oven and the Davis-Bierer Bomb Aging tests.

By this method a cracking of the surface, a hardening and coloring of the product, a decrease in the physical properties and the weight of the samples, and finally an increase in the acetone extract, takes place progressively with the time of

(*Continued on Page* 397)

Utilization of Extraction Steam

Much Heat Energy Otherwise Wasted is Converted into Electricity by Using a Turbine as a Reducing Valve

By E. D. Dickinson
Designing Engineer, Turbine Engineering Department, General Electric Company

SOME years ago I heard a statement made to the effect that before long we would see no more small turbines being installed for the reason that it would be found uneconomical to generate electric power in small power stations. It is true that the large stations have made such improvements in efficiency that they are able to produce a kilowatt hour at a figure far below what might be expected in any industrial plant, and if we consider the cost of electric power alone, the statement would be justified. However, we find that an increased number of the smaller turbines are being sold and at the same time there is a marked tendency toward increased capacity.

Engineers are constantly striving for greater economies and in analyzing the costs in any manufacturing industry, the charges that have to be allowed for heat and power must be given the same consideration as those for labor and materials. Therefore, the engineer is always on the lookout for means whereby these two items can be reduced.

In the early days of the steam turbine it was recognized that a certain amount of power could be produced at relatively low cost by the use of low pressure or mixed pressure turbines and a number of this type were installed with very gratifying results. As power plants developed and an increased number of condensing turbines were installed the amount of low pressure steam available to be transformed into useful work was reduced. This accounts for the decreased use of the mixed pressure turbine.

Heat Balance Worthy of Study

Further studies of manufacturing processes showed that in many instances large amounts of steam were being generated only to be used at a lower pressure after passing through reducing valves. It was apparent that a great deal of heat energy was being wasted that might be converted into electricity by the simple expedient of using a steam turbine as a reducing valve. With the more general use of higher pressures and temperatures the amount of power that can be so generated is very much increased. We now find that wherever consideration is being given to remodeling or increasing existing power plants, very serious consideration is being given to the installation of high pressure boilers fitted with superheaters, and a most careful study is being made of the heat balance to be obtained in power houses in conjunction with the manufacturing processes.

In many instances where sufficient power cannot be generated by the non-condensing turbine it has been found desirable to use turbines arranged for bleeding the requisite amount of steam from one or more of the stages. These we call the extraction type turbines.

In its simplest form, any turbine provided with an opening in the shell might be classed as an extraction turbine. In such it will be apparent that inasmuch as the stage pressure will fluctuate with the opening of the primary valves in response to the governor, the steam available for extraction will vary with the load. This type of extraction can be commended on the score of simplicity and in applications where the relation between steam demand and load is approximately constant, this type of turbine is admirably suited. This means it is most generally employed for providing steam for feed water heating and the necessary control is reduced to the minimum, as both the extracted steam and the flow to throttle will be approximately proportional to the electrical load. Control of pressure can be obtained up to the stage pressure by the introduction of a reducing valve in the extraction line.

There are two means generally employed for controlling the pressure in the stage from which steam is to be extracted. The one first developed and still used in many cases is to fit one or more blank diaphragms in the turbine, which to all intents and purposes divides the turbine into several turbines. In such machines the steam is all extracted and what is not required for process is admitted through a suitable valve into the lower pressure stages. The other method is to provide a suitable valve in the diaphragm following the stage from which steam is to be extracted. The valve is arranged to close or open the nozzle ports and maintain the proper pressure in the extraction stage. This is commonly called grid valve extraction. This method allows maximum efficiency to be obtained in an extraction type turbine and is particularly valuable in turbines where the steam is to be extracted at moderate pressures where the specific volume is great. Losses inherent to deflecting all of the steam from its path and the pressure drop losses due to carrying the steam through tortuous passages are avoided.

Steam Extracted from Several Stages

In some processes it has been found desirable, in order that maximum plant efficiency be obtained, to use steam at several different temperatures and pressures. This is done by extracting steam from several stages.

No general statement can be made as to the relative merits of the various types of extraction turbines. A thorough study of the heat and load cycle per day, week and year is necessary before recommendation can be made. In some instances where there are wide fluctuations in relative demands for electrical power and heat it has been found best to install both condensing and non-condensing turbines and reducing valves all designed to have similar characteristics, so that good regulation of both speed and pressure can be obtained. There are other instances where it has been found desirable to fit turbines with reducing valve extraction in the upper stages and grid valve extraction in the lower stages.

Whether one buys or generates electric power is entirely an economic question. In manufacturing plants where the electrical demand is relatively high and the steam demand small, it will probably be more economical to purchase power than to generate it.

Controlling Extraction Steam

In controlling extraction steam pressure on extraction type turbines many problems in governing are met with which are not encountered in straight condensing turbines. The governing mechanism must be extremely powerful and every precaution taken to reduce to minimum hunting or swinging of the load and pressure. In industrial plants the turbines are often subjected to rapid and severe changes in load and demand for process. The load swings are relatively greater than encountered on big systems, where the turbines operate at approximately constant load.

The kilowatt rating of a machine is no criterion of the capacity of the inlet valves or of the control demands that must be met by the governor. An extraction type turbine of 5,000 KW rated capacity may have a steam flow equal to a 20,000 KW condensing turbine. The demand for extraction steam may be continuously changing through a very wide range. The control mechanism must automatically maintain extraction pressure within commercial limits without change of the speed governor.

It is sometimes economical to arrange the extraction type

Read before the Affiliated Technical Societies of Boston on December 11, 1925.

turbine so that during periods in the manufacturing cycle, low pressure steam may be admitted to the extraction stage and used to generate electric power. Such turbines as this, of the mixed pressure type, serve a most useful and valuable purpose in maintaining approximately constant pressure and preventing waste in systems where an excess of low pressure steam cannot be avoided during certain periods.

A word on the subject of efficiency might be pertinent. We hear some talk in a general way of the high efficiencies that are being secured on this or that particular turbine. The highest that I have seen quoted on a non-condensing turbine was that of a Brunner turbine. This was rated 3,000 KW with 182 lbs., gauge pressure, at a steam pressure of 740° it showed a Rankine efficiency of approximately 84%. This means about 78% overall efficiency with 200 lbs. and 100 degrees superheat and including generators. It is my understanding that this turbine was built in two casings and had some 40 stages. It is altogether probable that the efficiencies reported were realized. However, the capitalized value of the saving that might be secured by such a turbine would not be warranted with the present price of fuel. On the other hand, turbines having efficiencies only a few percent lower are well justified. It must be borne in mind that these figures are all relative and as applying to average sizes of turbines generally used in industrial plants. Efficiency is not a general term. To be intelligently considered, we must specify all conditions, viz: capacity of turbine, pressure, superheat and back pressure. For the larger turbines used in the big power houses entirely different conditions exist and these must be given special consideration.

The design of the extraction and mixed pressure turbine is considerably more complex and takes a great deal more time than the straight condensing or non-condensing turbine. In discussing efficiencies one must always realize that the mixed pressure or extraction type turbine is a compromise. Every turbine is laid out to have the proper steam velocities at one load.

In the extraction type turbine the high pressure end must be designed to carry not only the steam required for extraction, but in addition, the steam which will pass through the low pressure stages to the condenser. Therefore, when such a turbine is operated straight condensing and with the same electrical load, the steam flows through both high and low pressure parts of turbine will be different and in consequence the efficiency will be affected. Speaking generally, in an extraction type turbine the high pressure end is relatively larger than would be for straight condensing and in a mixed pressure type turbine the low pressure end is relatively larger.

The following may be of interest. We have on order and in commercial operation in sizes from 500 to 3000 KW, approximately 300 of the non-condensing turbines, 200 arranged for reducing valve extraction and 300 arranged for grid valve extraction.

(In the next issue, A. D. Somes of the General Electric Co., will discuss the ways in which various types of steam turbines may be applied to the economical production of power in industrial plants, and will explain the difference between these types.—THE EDITOR.)

Papers Read at Chemists Meeting

(Continued from Page 394)

exposure. The coloring is at first a yellowing, ending in a brown shade with a purple hue. This is apparent to the eye and visibly the aging can be judged on pure rubber sulfur mixes which could not be done with the other methods of aging, except after a longer time of treatment.

This light-heat combination tried on boot stocks, auto tops, bathing cap materials, etc., acted in many respects to the pure rubber sulfur samples.

The action of the light is photo-chemical. The reaction velocity and the temperature coefficient can be determined as soon as the light of the lamp has been reduced to a monochromatic basis. At present it is known that the acceleration is produced both by the green rays around 5600°A and by the red rays in the region of 10,000°A. It is hoped that in future investigations the light action can be determined quantitatively, and incidently some light thrown on the mechanism of vulcanization.

THE OXIDATION OF RUBBER EXPOSED TO LIGHT

Ira Williams
Mellon Institute

Light has been found to promote rapid oxidation of rubber. This is especially true of rubber which is under strain when subjected to light of short wave length. Under these conditions a continuous inelastic film is produced on the surface of the rubber. In the absence of oxygen, light appears to have little effect. Ultra violet light causes the production of ozone which rapidly attacks strained rubber and causes cracking. These cracks assume the maximum length and depth when the rubber is stretched about 3%. Higher elongation produces a greater number of smaller cracks. Surface oxidation protects the rubber from the action of ozone. Rubber articles which are exposed to the sun may be prevented from cracking by catalyzing oxidation of the surface of the rubber before exposure.

THE OXIDATION OF RUBBER AT VARIOUS TEMPERATURES

Brian Mead and John C. Pope
Research Dept., Massachusetts Institute of Technology

Pure extracted rubber has been oxidized in the form of thin films at temperatures varying from 100 to 30 degrees centigrade. The amounts of carbondioxide, and of water vapor which are evolved during the oxidation reaction have been determined and differences have been found in the mechanism of oxidation as the temperature is changed between these limits. A tentative explanation of these differences is proposed.

A NEW MECHANICAL TEST FOR RUBBER INSULATION

C. L. Hippensteel
Western Electric Co.

Aerial use of rubber covered wire requires that the rubber insulation shall resist cutting by the conductor at points of support and shall not crack at points of extreme flexure. This paper is a preliminary report on a test as yet not fully developed, which we have endeavored to work out as a rapid routine test for numerically expressing these qualities.

In the proposed test a two inch section of insulated wire is subjected to a uniformly increasing compressive load between parallel steel blocks until rupture of the insulation occurs. The load at rupture is a measure of the relative ability of the insulating material to resist cutting. The thickness at rupture is related to its ability to withstand severe bonding. An experimental machine designed to make such a compression test is described.

RECLAIMED RUBBER AS A SUBSTITUTE FOR NEW RUBBER AND ITS ECONOMIC STATUS IN THE PRESENT CONTROVERSY

J. M. Bierer and C. C. Davis
Boston Woven Hose & Rubber Co.

The present controversy over the high price of rubber tends to ignore in its technical aspects the conditions under which reclaimed rubber may be substituted for new rubber on a quantitatively economical basis.

It is in fact possible to compound many stocks, including tire treads, with rubber and reclaim instead of with rubber alone and maintain the same quality. Where the cost of rubber and of reclaim renders such replacement economical and where the use of reclaim is not precluded because of physical or chemical requirements, the money value of a reclaim can be determined for any cost of rubber. On such a quantitative basis, it becomes possible to know when and how to use rubber and reclaim to obtain the most economical stock of the desired quality.

Three New Applications of Rubber

Rubber Cushions Used in "Springless Suspension", Shock Eliminator and Bumper

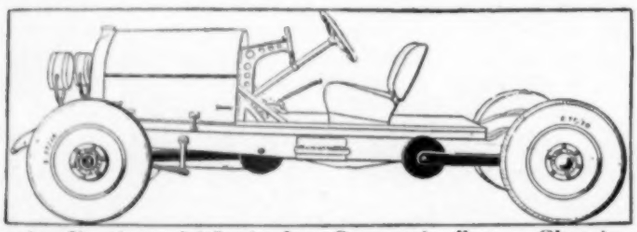
THE ADAMS Springless Suspension Corp. Inc., New Haven, Conn., of which W. Lawson Adams is president, uses a ring-shaped molded rubber cushion in three of its products which are attracting wide interest in the automotive industry. Mr. Adams, who is an automotive engineer of reputation in both this country and England, has developed a "springless suspension" for automobiles, a shock eliminator designed on a new principle and a bumper which has many exclusive features. In these three products the property of rubber to absorb shocks and stresses and its long life when kept "working" are cleverly applied.

The "Springless Suspension" is extremely simple in principle, as may be seen from the photograph on this page. In place of the usual spring, a strong, stiff, pressed steel cantilever is used, attached at one end to the axle and fitted with a steel drum at the opposite end. The interior face of this steel drum is fitted with radial serrations or teeth. On the frame of the car a steel disc also provided with teeth is bolted. Between these two members of the suspension is placed a molded ring-shaped rubber cushion provided with teeth which fit those of both the drum on the cantilever and the disc on the frame of the car. Through the axis of the disc and drum runs a steel bolt fitted with a castellated nut at each end. The three units are bolted tightly together.

The rubber ring is of such size that under compression, the rubber is forced outward toward the circumference of the disc. The effect is to cushion the inside periphery of the drum with rubber. Before assembling, the rubber ring is coated with a preservative to prolong its life.

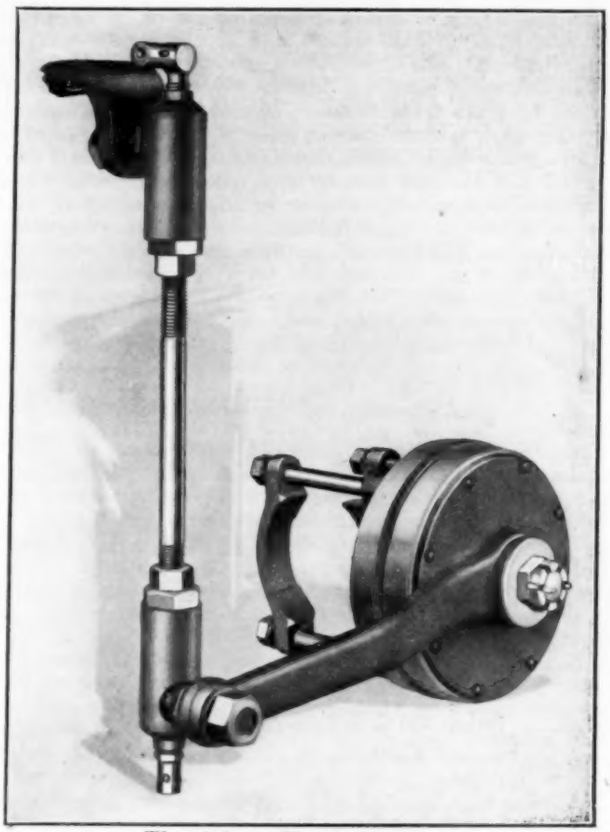
In operation, when a car equipped with Mr. Adams' suspension strikes a bump in the road, a slight rotary motion is imparted to the drum through the medium of the cantilever. This rotary motion is not taken up by the teeth of the rubber ring, however, as these are provided merely to hold the ring in place. When the metal drum turns, the ring is expanded in a circumferential direction. This feature eliminates the need of shock absorbers or snubbers for while a metallic spring is pulsating approximately six times in either direction, there is but one pulsation with the rubber suspension.

The development of "Springless Suspension" and the two other Adams' products go back a good many years to the days when Mr. Adams was a small boy. At that time vehicles had their wheels shod with iron tires. He lived in a country village four miles from Sandringham, England, where Prince Edward, father of the present King, used to drive down to catch trout in the stream where the elder Adams had a mill. One day as Prince Edward was about to return, the boy was sent around to order the dog cart from the stables. In driving back over the cobble stones with the coachman he noticed that there was no rattle and saw that the wheels were shod with rubber tires instead of the usual steel bands.



Application of "Springless Suspension" to a Chassis

In a letter to THE RUBBER AGE, Mr. Adams wrote that he had used his inventions, covered by a basic patent No. 1,515,716, for many purposes where springs are usually employed, such as, eliminating valve springs on airplane engines running at high speeds when there is a tendency for the valve to bounce. The Adams' device for stretching rubber circumferentially can be used with 24 valve springs on a cylinder (which is the number one airplane engine manufacturer uses) and eliminates all the valve flutter or bouncing entirely. The device is also applicable for tipping up theater seats, landing gears on airplanes, swivel chairs and other office furniture, and for eliminating the shackles and shackle bolts on automobiles.



The Adams Shock Absorber

The development of "Springless Suspension" brought to light the possibilities of these other uses, and a shock absorber and bumper, both operating on the same principle as the suspension system, were designed by the inventor. The shock absorber takes either one of two forms. It may be a single arm connected to the axle through an auxiliary arm and with the drum, disc and rubber cushion on the frame, or it may be a double-armed device with the arms opening and closing like a scissors.

In its application to a bumper, the rubber ring assembly is mounted at the extreme forward end of the frame. Above the assembly is a cylinder through which a piston-like arrangement attached to the bumper proper moves. Normally the rear end of this "piston" rests against a small hub attached to the drum of the rubber ring assembly. When pressure is exerted on the bumper, the piston presses against the hub, which in turn rotates the drum and the shock is absorbed and cushioned by the rubber ring. Not only are rubber rings used in the Adams' bumpers, but the ends are covered with rubber to avoid damaging the car ahead when the owner is getting out of a close parking squeeze and rushes the fender of the other car with the bumper.

The Market Place

WHERE TO OBTAIN
Machinery, fabrics, chemicals, compounding ingredients, crude and reclaimed rubber, consulting chemical
1.

ACCELERATORS—X L O and Diphenyl Guanidine.
Dovan Chemical Corp.
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ACCELERATORS — Two new accelerators: Vulcone and Di-ortho-tolylguanidine.
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Dyestuffs Dept. Sales Div.
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Grasselerator 552
Grasselerator 808
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Akron Ohio

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Rare Metal Products Co.
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Direct Factory Representation

FOLLOW-UP
Your mail efforts by a listing in this section. It will repay you the slight cost.

TWELVE
New Listings in this section
within the past few weeks serve as an indication of its value to the rubber industry.
Your Products Listed Here
reach buyers in rubber factories at a cost lower than is possible by any other method.
ARRANGE FOR YOUR LISTING TODAY!

ASBESTINE—Specially prepared for use in Rubber. Send for liberal working sample.
SOLE PRODUCERS
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BEAD CABLES— National Flat Woven and Pratt Patent Bead Cables.
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CARBON BLACK
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612 Metropolitan Bldg., Akron, O.

CARBON BLACK—*Aerfloted* Arrow Black for rubber compounding. Standard for grit-free uniformity.
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CARBON BLACK — *Black Goose Brand*—free from grit and impurities and imparts high tensile strength to the rubber compound.
Union Power Co., Inc.
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CARBON BLACK or any other compounding material used by rubber manufacturers can be marketed at low cost by listing it in *The Market Place.*

CASES—Fibre construction, insure satisfactory shipping results. Send for sample.
Brooklyn Fibre Syndicate, Inc.
Decatur St. & Irving Ave.
Brooklyn, N. Y.

CATALPO— A colloidal and gritless clay now being used as a reinforcing pigment in number one treads, solids, and tubes.
Moore & Munger
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New York City

CHEMISTS read your listing in the MARKET PLACE. There is no cheaper way to reach these prospects.
Try It!

THE MARKET PLACE Section Continued on Second Page Following.

MARKETS

Cottons and Fabrics

NEW YORK, March 1, 1926

The Census Bureau's report on domestic consumption, exports and imports during January gave a total supply in the U. S. to January 31 of 18,770,786 bales and a supply on hand, after cotton and linters consumption to that date, including exports, of 9,775,697 bales. The quantity of lint cotton in consumers' hands at the end of January was 1,811,392 bales, equivalent to more than a three months' supply.

Operations were largely confined a week ago to the evening up of near month commitments prior to the advent of the first March notice day, and, as local stocks continued to decrease, a steady undertone was maintained. As expected, very few notices were circulated, but their failure to bring about a covering movement, which may have been due to reports that upwards of 15,000 bales were in process of shipment to New York for delivery on contract, fostered the growth of bearish sentiment.

Spot demand has been disappointing and prospects are that the next crop will receive a favorable and early start. With reports of an easier basis becoming more general, the time may not be far distant, says A. Norden & Co., when pressure of offerings in the South may become a source of decided weakness, particularly as far as old crop positions are concerned. On the other hand, it is not improbable that, unless Southern holders of deliverable grades bring their price ideas into line with the values obtainable through the contract markets, both May and July will, as they in turn become spot months.

Statistically, the position of American cotton is not encouraging. From January 1 to February 19, world's spinners' takings were about 400,000 bales less than during the corresponding period last year and, as long as new crop months sell at their present discounts, no relative improvements appear likely. Domestic manufacturing activity, however, continues at a high rate and, although forward commitments are exceptional, purchases of goods for the filling of immediate requirements have been sufficiently large in the aggregate to take care of production.

It is believed that in the near future the bearish features of the situation will govern the old crops months, especially May. In considering new crop positions their relative cheapness, the good character of buying which is in evidence on each small decline and the uncertainties which must be associated with next season's production, should be studied.

New York Prices

	Open	High	Low	Close	Close Feb. 15
March	19.22	19.22	18.92	18.94	20.05
May	18.60	18.61	18.35	18.40	19.53
July	18.00	18.01	17.75	17.77	18.88
October	17.50	17.50	17.22	17.23	18.24
December	17.18	17.19	17.92	17.95	17.87

Tire Fabrics

During the year 1925, fabric consumption in tires totaled 168,195,927 pounds as reported to the Rubber Association by manufacturers representing 75 per cent of the industry. Demand during the last two weeks has been limited, with prices held nominally unchanged. Less than the expected revival of tire manufacturing interest has been displayed although rubber is selling at cheaper levels. Tire manufacturers are covering their spring requirements carefully and as a result, producers have been accumulating fabric stocks on a largr scale than was anticipated.

CORD FABRICS

Combed Sakellarides		Nominal	
Combed Peeler	lb.	Nominal	
Carded Peeler		.47 @	.48
Combed Egyptian uppers	lb.	.63 @	—
Carded Egyptian uppers	lb.	.56 @	.58

SQUARE WOVEN

17¼-ounce Egyptian uppers, combed	lb.	Nominal	
17¼-ounce Egyptian uppers, carded	lb.	.54 @	.57
17¼-ounce Sakellarides, combed	lb.	Nominal	
17¼-ounce Peeler, carded	lb.	.45 @	.46

Ducks—Most mills report that they have enough business to keep looms running into April and in some cases May and June. There has been some interest shown in the boll grades of cotton for rubberizing. A slightly easier price tendency was noted in reference to enameling duck on the basis of actual business. The demand continued of a spot and nearby character.

Burlaps—There has been a better feeling throughout the trade, induced by the belief that bottom values must be fast approaching. Little more decline was anticipated in the 8s, although the belief prevailed that the 10½s could stand a little easing. The trade is puzzled as to how long the low quotations will prevail. Demand has been spotty.

SHEETINGS

40-inch	2.50-yard	yd.	.13⅞ @	—
40-inch	2.85-yard	yd.	.12¼ @	—
40-inch	3.15-yard	yd.	.13½ @	—
40-inch	3.60-yard	yd.	.11½ @	.11¾
40-inch	3.75-yard	yd.	.10¼ @	.10½
40-inch	4.25-yard	yd.	.09 @	.09¼

DUCKS

Belting	lb.	.37½ @	.38½
Hose	lb.	.37½ @	.38½
Enameling	lb.	.39 @	.44
Shoe Ducks	lb.	.41 @	.46
Single filling	lb.	.17 @	.19
Double filling	lb.	.20 @	.21

BURLAPS

(Carload Lots)

7½-ounce	40-inch	7.20 @	7.25
8 -ounce	40-inch	7.45 @	7.50
10 -ounce	40-inch	9.90 @	9.95
10½-ounce	40-inch	10.10 @	10.15

J. H. LANE & CO.

Tire Fabrics Cord Fabrics

Enameling Duck Drill Sheeting

Osnaburg and Special Constructions

250 W. 57 Street, NEW YORK 323 South Franklin St., CHICAGO

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The Market Place 2.

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TIRE BUILDING MACHINES

The Banner Machine Co.
Columbiana, Ohio
Paul A. Frank, Akron, Ohio, Agent.

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CHEMICALLY PURE BRIGHT RED OXIDES

Unsurpassed for fineness, strength and uniformity.

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109 Liberty Street, New York City.

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Send us Your Inquiries.

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FABRICS—Tire fabrics, Egyptian—Peeler, Karded and Combed, Cord and Square.

Cabarrus Cotton Mills
(Cannon Mills, Inc.)
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Refined Pine Tar
(Moisture Free)
Petrolatum--Burgundy Pitch.
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DIPHENYLGUANIDINE

Aero Brand, product of the highest purity from dependable source of supply.

American Cyanamid Co.
511 Fifth Ave. New York City.

FABRICS—Spots and Contracts: Tire Fabrics, Enameling ducks, Tube Wrapping Tapes.

H. Frank Jones
395 Broadway New York City

CHEMICALS and compounding ingredients for the rubber trade.

Harshaw, Fuller & Goodwin Co.
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DRY KILN—for drying crude rubber and chemicals—Hunter Process.

Carrier Engineering Corporation
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FABRICS—Tire, cords, enameling ducks, drills, sheetings, osnaburgs.

J. H. Lane & Co.
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CHEMICALS — Accelerators
Trimene Base, Heptene, Monex, Crylene, Lithex, Thiocarbanilide, Triphenylguanidine, Aniline Oil.
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Antioxidant—VGB, a proven product.
Labels—all-rubber two color brands.

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FABRICS—Tire fabrics—coarse builders, chafers, breakers in all grades.

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FABRICS—Stockinets, Jersey Cloth and Special Fabrics for the Rubber Industry.

U. S. Knitting Co., Inc,
Pawtucket, R. I.

THE MARKET PLACE Section Continued on Second Page Following.

Reclaimed Rubber

NEW YORK, March 2, 1926

Most reclaiming plants continue to operate at capacity in anticipation of a demand which is expected to begin within the next month, as well as to fill current withdrawals which show no sign of falling off. Good consumption continues despite the fact that some of the larger tire manufacturers have curtailed production slightly. It is thought that the recent reduction in reclaimed prices will make for a more stable situation.

Friction (Uncured)				
No. 1	lb.	.40	@	.45
No. 2	lb.	.35	@	.40
High Tensile Black				
Super-Reclaim No. 1	lb.	.28	@	.30
" " No. 2	lb.	.21	@	.22
Shoe				
Unwashed	lb.	.10½	@	.10¾
Washed	lb.	.13	@	.13¼
Tube				
No. 1 (Floating)	lb.	.25	@	.30
No. 2 (Compounded)	lb.	.19	@	.20
Tires				
Black, unwashed	lb.	.11	@	.11¼
Black, washed	lb.	.12½	@	.12¾
Black, selected tires	lb.	.12¾	@	.13
Dark Gray	lb.	.15½	@	.16¾
Light Gray	lb.	.18	@	.18½
White	lb.	.22½	@	.23
Truck, Heavy Gravity	lb.	.10½	@	.11
" Light Gravity	lb.	.11	@	.11½
Miscellaneous				
Mechanical Blends	lb.	.08	@	.09
Red, High Grade	lb.	.23	@	.23½

Scrap Rubber

NEW YORK, March 2, 1926

Dullness has continued in the scrap rubber market and with orders from mills lacking, dealers have practically all grades on hand. Indications point to lower prices, because spring accumulations of scrap are beginning to come in and reclaimers, who have enough scrap on hand to carry them for some weeks, are not disposed to place new contracts. Although low prices of crude rubber have caused some uneasiness in the scrap market, there was no actual pressure to sell noted among dealers.

Auto tire peelings	.01¾	@	.01¾
Standard White auto ton	37.50	@	40.00
Mixed auto ton	26.00	@	27.00
Bicycle tires ton	15.00	@	17.00
Clean solid truck tires ton	37.00	@	40.00
Boots and shoes	.02¼	@	.02¾
Arctics, untrimmed	.01	@	.01⅛
Arctics, trimmed	.01⅜	@	.01½
Inner tubes, No. 1	.08½	@	.08¾
Inner tubes, No. 2, compounded	.07¼	@	.07½
Air Brake Hose ton	24.00	@	25.00
Rubber hose ton	15.00	@	17.00

Crude Rubber

NEW YORK, March 1, 1926.

On the 23d low prices on both exchanges and street brought out buyers and there was some rather sharp trading, in which sales of nearby positions were featured in the street and May and July on the exchanges. On the Rubber Exchange sales amounted to 120 lots (300 tons). The market was steady and dull during the next morning, but livened up in the afternoon on lower prices by sellers. Weakness developed when the Department of Commerce arrival figures were published. The Rubber Association figures showed January arrivals at 38,000 tons, with consumption approximately 32,000 tons. The Government figures showed net arrivals of 42,320 tons.

Reports from Akron indicated that the tire business was dragging considerably, and unless there is an improvement, traders expect rubber prices to go lower. Resales of rubber by manufacturers have been pronounced, and postponements have been asked for. These conditions were too much for the market to withstand without weakening, and on the 25th prices dropped to the year's low level. Reaction carried some of the more active positions about four cents under the previous closing.

On the 26th the market opened weak with London and New York below even the previous day's record low levels. Prices later began to move forward on London strength and more trading interest in New York. However, prices showed a net loss for the day. There was no business done on the Cocoa & Rubber Exchange but on the Rubber Exchange of New York a new high record was set when 171 lots (427½ tons) were turned over. July made a low of 45.20 and May of 46.20 before noon. During mid-afternoon it reached 50.50 for May and 49.50 for July, after which selling drove it down to a closing only 80 points over the opening levels.

The market opened firmer and remained fairly firm on Saturday. Today it rallied sharply. Spirited bidding for May and July featured the trading on the Rubber Exchange where 165 contracts, equivalent to 412½ tons, changed hands. The advance in prices of nearly 4 cents a pound came in the face of bearish figures for February. Imports were expected to be increased to 37,000. Better feeling among smaller manufacturers and a more optimistic tone in the London market were said to be chiefly responsible for the advance.

NEW YORK MARKET

Plantations—			
Ribbed Smoked Sheets			
Spot	.54	@	.55
March	.54	@	.55
April/June	.53	@	.54
July/Sept.	.52	@	.52½
First Latex, crepe spot	.55	@	.56
Amber Crepe, No. 2, spot	.54	@	—
" " No. 3	.53	@	—
" " No. 4	.52	@	—
Brown Crepe, Rolled	.49	@	—
" " Clean, thin	.52	@	—
" " Specky	.50	@	—
Pontianac—			
Bangermassin	Nominal		
Palembang	Nominal		
Prime Pressed	Nominal		
Sarawak	Nominal		
Paras—			
Up-river Fine	.47½	@	—
" Medium	.41	@	—
" Coarse	.39	@	—
Islands, Fine	.43½	@	—
Acre Bolivian, fine	.48	@	.51
Tapajos, fine	.40	@	.42
Cut Beni Bolivian, fine	.46	@	.50
Caucho Ball—			
Upper, shipment	.38	@	—
Centrals—			
Corinto, scrap	.35	@	—
Esmeraldo, sausage	.36	@	—
Guayule, w and d	.43	@	—
Africans—			
Benguela, No. 2	Nominal		
Congo, upper, black	Nominal		
" " red	Nominal		
Kassai, Prime Red	Nominal		
Balata—			
Block, Columbia	.65	@	—
" Cuidad	.62	@	.63
Surinam, sheet	.68	@	.70
Gutta Percha—			
Siak	.23	@	.25
Red Macassar	$3.50	@	—
Chicle—			
Mexican, Yucatan	.58	@	.68

LONDON MARKET

Standard Ribbed Smoked Sheets—	
Spot	27½d
March	27¼
April/June	27
July/Sept.	26½
Oct./Dec.	26½

SINGAPORE MARKET

Standard Ribbed Smoked Sheets—	
Spot	24⅛d
Feb./March	24⅛
April/June	23¾
July/Sept.	23⅝

PEQUANOC RUBBER COMPANY
Office and Works: BUTLER, N. J.
MANUFACTURERS OF
RECLAIMED RUBBER
WITH A REPUTATION FOR
UNIFORMITY - RELIABILITY - CLEANLINESS

The Market Place

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FACTICE—Prevents blooming, makes colors fast and a smoother batch.

Stamford Rubber Supply Co.
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MICA — Water Ground and Water Floated — 160 Mesh —Absolutely Free from Grit. Akron Stocks, also Factory Shipments.

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GUAYULE—"Duro" Brand washed and dried ready for compounding.

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FOR TIRES, MECHANICAL GOODS & DRUGGIST SUNDRIES.
The Akron Rubber Mold & Machine Co.
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RECLAIMED RUBBER
A standardized grade for every requirement.
U. S. Rubber Reclaiming Co., Inc.
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"43 Years Serving the Industry Solely as Reclaimers"

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MOLDS AND CORES—
Tire building equipment; general machine work.
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RED OXIDE—A special grinding, guaranteed uniform in color and quality.

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MACHINERY—
Heater Presses, Molds and Cores, Tubing Machines.
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MOLDS & CORES—Tire building machines; tire finishing stands; tubing machines; hydraulic presses.
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Prompt Service—Let us quote you.
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MOLDS & CORES—for automobile tires; general machine work.
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RUBBER FOAM—in sheets. For padding, insulation and a hundred uses. Water proof. Will never rot. One-quarter the weight of cork. The Wonder Product.
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We specialize in fine Grey, Black and Red Reclaimed Rubber.
Send us Your Inquiries
The Defiance Rubber Co.
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RECLAIMED RUBBER—
Uniformity, reliability, cleanliness.
Pequanoc Rubber Co.
Butler, N. J.

YOUR NAME
in this space would be seen by Buyers, Chemists, Engineers and Executives in all rubber plants.
Write for full information

THE MARKET PLACE Section Continued on Second Page Following.

CHEMICALS & COMPOUNDING INGREDIENTS

Accelerators — Colors — M.R. — Compounding Ingredients
Softeners — Vulcanizing Ingredients — Rubber Substitutes

NEW YORK, March 2, 1926—Trading in chemicals and compounding ingredients during the past fortnight was spotty. Although demand fell off somewhat in February, when compared with the average set by January sales, this condition applied most to the spot market, and the dull conditions of the two weeks just closed cannot be said to have been experienced by all manufacturers, as contract shipments continued at a fairly steady rate. Although curtailment of tire production by some of the larger manufacturers has been felt by chemical houses, they are confident that this condition is only temporary and that the next few weeks will see a return to the large demand enjoyed in January, with increases expected in some cases. Quotations have been steady; fluctuations were principally confined to chemicals in limited demand in the rubber industry. Diphenylguanidine was one of the few important chemicals which registered a decline.

ACCELERATORS

Organic			
Aledhyde ammonia, crystals	lb.	.82 @	—
Aniline oil, drums	lb.	.17 @	.17½
Crylene	lb.	.70 @	—
paste	lb.	.50 @	—
Di-Ortho-Tolylguanidine	lb.	1.05 @	1.08
Diphenylguanidine	lb.	.85 @	.88
Ethylidene aniline	lb.	.60 @	.65
Excellerex	lb.	.35 @	.40
Formaldehyde-Aniline	lb.	.40 @	.42½
Grasselerator 102	lb.	.80 @	.82
Grasselerator 552	lb.	4.80 @	5.00
Grasselerator 808	lb.	1.50 @	1.75
Heptene	lb.	.55 @	—
Hexamethylene-tetramine	lb.	.80 @	.82½
Monex	lb.	4.00 @	5.00
Paraphenylenediamine	lb.	1.25 @	1.30
Piperidine-Piperidyldithio-Carbamate	lb.	4.80 @	5.00
R & H 50	lb.	.60 @	—
Super-Sulphur No. 1	lb.	.50 @	—
Super-Sulphur No. 2	lb.	.18 @	—
Tensilac, No. 41	lb.	.65 @	—
Thiocarbandlide, kegs	lb.	.28½ @	—
Triphenylguanidine	lb.	.70 @	.73
Tuads	lb.	4.50 @	5.00
Vulcone	lb.	.75 @	.79
Zimate	lb.	5.00 @	—
Inorganic			
Lead, sublimed blue	lb	.10 @	.10½
Lead, white	lb.	.10¾ @	—
Litharge, domestic	lb.	.11¾ @	.12½
Lime, superfine	lb.	.01½ @	.02
Magnesia, calcined, light	lb.	.10 @	—
extra light	lb.	.40 @	.45
heavy	lb.	.04½ @	—

COLORS

Blacks			
Arrow "Aerfloted"	lb.	.09½ @	13½
Bone Black	lb.	.05½ @	.11
Carbon "	lb.	.09 @	.13
Drop "	lb.	.07½ @	.14
Ivory "	lb.	.12 @	.45
Lamp "	lb.	.12 @	.40
Micronex	lb.	.10 @	.14
Thermatomic carbon	lb.	.05 @	—
Blues			
Prussian	lb.	.33 @	.34
Ultramarine	lb.	.08 @	.35
Browns			
Sienna, Italian	lb.	.04 @	.14
Umber, Turkey	lb.	.04 @	.06
Greens			
Chrome, light	lb.	.28 @	.31
medium	lb.	.30 @	.32
dark	lb.	.31 @	.33
commercial	lb.	.09 @	.10
Chromium Oxide, bbl.	lb.	.30 @	—
Reds			
Antimony crimson, 15/17	lb.	.27 @	—
sulphur free	lb.	.48 @	.50
vermillion 15/17	lb.	.37½ @	—
golden, 15/17 F.S.	lb.	.16 @	—
pentasulphide, pure	lb.	.33 @	.35
15/17 F.S.	lb.	.26 @	.30
Indian English	lb.	.11 @	.15
Oximony	lb.	.13½ @	—
Para toner	lb.	.85 @	.95
Red oxide, reduced	lb.	.04 @	.12
pure	lb.	.12 @	—
Blue Ridge	lb.	.12 @	—
Toluidine toner	lb.	1.80 @	2.10
Venetian red	lb.	.01½ @	.05
Vermillion, quicksilver, English	lb.	1.40 @	1.45
Whites			
Albalith	lb.	.05⅞ @	.06¼
Aluminum bronze		.55 @	1.20
Lithopone, Akcolith	lb.	.05⅝ @	.06
Lithopone, Azolith	lb.	.05⅝ @	.06½
Zinc Oxide—American Process XX red	lb.	.07½ @	.07¾
Kadox, black label, kegs	lb.	.10⅝ @	.11¼
blue " " "		.09⅝ @	.10½
red " " "		.08⅝ @	.09½
American Azo: ZZZ (lead free)	lb.	.07¼ @	.07¾
ZZ (under 5% leaded)	lb.	.07 @	.07½
Zinc Oxide—French Process White seal	lb.	.12⅝ @	—
Green seal	lb.	.11½ @	—
Red seal	lb.	.10¼ @	—
Yellows			
Chrome, light		.17½ @	.18
dark and medium	lb.	.17½ @	.18
Cadmium Sulphide	lb.	1.20 @	1.50
Ocher, French medium	lb.	.03¼ @	.03⅜
domestic	lb.	.01¾ @	.02½

COMPOUNDING MATERIALS

Aluminum Flake (f.o.b. plant)	ton	21.85 @	24.50
hydrate light	lb.	.16 @	.17
Ammonia carbonate	lb.	.10 @	.10½
Are-O Scl	ton	8.00 @	11.00
Asbestine	ton	14.50 @	18.50
Barium carbonate	lb.	.03½ @	—
Barium Dust	lb.	.05 @	.06
Barytes southern off-color,	ton	12.00 @	18.00
Western prime white	ton	23.00 @	—
imported	ton	27.00 @	34.00
Basofor	lb.	.04½ @	—
Blanc fixe dry f.o.b. works	lb.	.03¾ @	.04
Carrara filler	lb.	.01¾ @	.02
Catalpo (fact.)	ton	38.00 @	40.00
Chalk, precip., extra light	lb.	.04¼ @	.05
heavy	lb.	.03¼ @	.04
Clay, China, domestic	ton	15.00 @	25.00
Aerfloted Suprex	ton	20.00 @	30.00
Dixie	ton	20.00 @	35.00
Blue Ridge, Dark	ton	9.00 @	—
" " Light	ton	12.00 @	—
Langford	ton	12.00 @	22.00
Glues, extra white	lb.	.20 @	.29
medium white	lb.	.18 @	.24
common bone	lb.	.12 @	.14
Graphite flake, bbls.	lb.	.06½ @	.12
Liquid latex	gal.	3.00 @	—
Magnesia, carbonate	lb.	.06¾ @	.09
Mica, powdered	ton	65.00 @	80.00
Rotten Stone (powdered)	lb.	.02½ @	.04½
Soapstone, powdered	ton	15.00 @	22.00
Starch, powdered	cwt.	3.81 @	—
Talc, domestic	ton	16.00 @	18.00
Terra Alba	cwt.	1.25 @	2.00
Tripoli, white	lb.	.02 @	.02¼
Whiting, commercial	cwt.	1.00 @	1.15
Alba	ton	12.00 @	—
gilder's bolted	cwt.	1.25 @	1.35
English cliffstone	cwt.	1.50 @	—
Paris whiteAmerican	cwt.	1.25 @	1.50
Quaker	ton	13.00 @	15.00
Superfine	ton	10.00 @	12.00
Sussex	ton	8.00 @	10.00
Wood pulp XXX	ton	35.00 @	—
" " X	ton	25.00 @	—

MINERAL RUBBER

Genasco (factory)	ton	50.00 @	52.00
Granulated M.R.	ton	33.00 @	—
Hydrocarbon, Hard	ton	29.00 @	—
Hydrocarbon, Soft	ton	29.00 @	—
320/340 M.P. hydrocarbon (c. l. factory)	ton	47.00 @	52.00
300/310 M.P. hydrocarbon (c. l. factory)	ton	42.00 @	47.00
Paradura	ton	70.00 @	72.50
Robertson, MR, solid	ton	35.00 @	75.00
M.R. (gran)	ton	42.00 @	80.00

SOFTENERS

Acids			
Acetic, 28%	cwt.	3.25 @	3.50
Cresylic, 97%	gal.	.65 @	.72
95%		.62 @	.69
Muriatic, 20%	cwt.	.80 @	.90
Nitric, 36 degrees	cwt.	4.75 @	5.00
Sulphuric, 60 degrees	ton	10.00 @	11.00
66 degrees	ton	14.00 @	15.00
Tartaric, crystals	lb.	.29 @	—
Alkalies			
Caustic soda, 76%	cwt.	3.20 @	—
Soda ash, 58% C.L.	cwt.	1.43 @	1.45½
Oils			
Castor, No. 3 bbls.	lb.	.12½ @	—
Corn, crude, bbls.	lb.	.11¼ @	—
refined	lb.	.13 @	—
Cottonseed, crude		.10½ @	—
Glycerine, C.P. drums	lb.	.25 @	.26
Linseed, Raw C.L.bbl.	gal.	1.04 @	—
Liquid Rubber	lb.	.12 @	—
Moldrite	lb.	.05 @	.06
Palm, Lagos		.08¾ @	.08⅞
Niger	lb.	.08½ @	—
Peanut, domestic crude	lb.	.12¼ @	—
Petrolatum, white		.11½ @	.11⅝
amber		.03⅞ @	.04
dark amber	lb.	.03⅝ @	.03¾
Pine, steam distilled	lb.	.60 @	.65
Rapeseed, refined	gal.	.86 @	.92
blown	gal.	1.05 @	—
Rosin, first rectified	gal.	.78 @	—
second rectified	gal.	.82 @	—
Soya Bean, crude		.10½ @	—
Synthecite	lb.	.06 @	—
Tar, commercial	gal.	.30 @	.32
Resins and Pitches			
Tar Retort	bbl.	16.00 @	17.00
kiln burned	bbl.	15.00 @	16.00
Pitch, Burgundy	lb.	.06 @	.06½
coal tar	gal.	.05½ @	.06
pine	bbl.	8.50 @	9.50
Rosin, grade K	bbl.	15.50 @	—
Solvents			
Alcohol denatured, No 1 bbls.	gal.	.39 @	.47
Benzol, 90%	gal.	.28 @	.30
pure		.32 @	—
Carbon bisulphide	lb.	.05½ @	.06¼
tetrachloride	lb.	.06½ @	—
Dimethylaniline	lb.	.31 @	.32
Motor gasoline, steel bbls.	gal.	.18 @	—
Naptha, V. M. & P.	gal.	.14¾ @	—
Toulene	gal.	.31 @	—
Turpentine, spirits	gal.	1.01 @	1.02
wood	gal.	.90 @	.92
Waxes			
Beeswax	lb.	.60 @	.61
Carnauba, No. 1	lb.	.48 @	.49
Ceresin, white	lb.	.10 @	.11
Montan, crude	lb.	.06 @	.06½
Ozokerite, black	lb.	.24 @	.25
green	lb.	.26 @	.30
Paraffine White A.M.P.	lb.	.05¼ @	.05⅜
Yellow A.M.P.	lb.	.05⅛ @	.05¼

ANTI-OXIDANTS

VGB	lb.	.70 @	—

SUBSTITUTES

Black	lb.	.08½ @	.14
White	lb.	.10 @	.17
Brown	lb.	.10 @	.15
Brown factice	lb.	.10 @	.16
White factice	lb.	.10½ @	.17½

VULCANIZING INGREDIENTS

Black hyposulphite	lb.	.18 @	.20
Ethyl Chloride, Cyl.	lb.	.55 @	—
" " Drums	lb.	.45 @	—
Sulphur Chloride (drums)	lb.	.04 @	—
Sulphur flour Superfine, bags	cwt.	2.20 @	2.50
" bbls.	cwt.	2.60 @	2.90
100% pure, refined, bags	cwt.	2.35 @	2.90
bbls.	cwt.	2.90 @	3.15